ROHDE&SCHWARZ

Test and Measurement
Division

Software Manual

cdma2000 Base Station Test

Application Firmware R&S FS-K82

1157.2316.02

Printed in the Federal
Republic of Germany

Digitized by the Internet Archive
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https://archive.org/details/manualsplus_11581

Contents

Safety Instructions
Certificate of Quality
Support Center Address
List of R&S Representatives

Contents of the Application Firmware R&S FS-K82 Manual

cdma2000 Base Station Test - Application Firmware R&S FS-K82 7

Installation 1.1
Enabling 1.1
Default settings in cdma2000 BTS mMode 2.2
Measurement 1: Measuring the signal power 2.3
Measurement 2: Measuring the spectrum emission mask 2.4
Measurement 3: Measuring the relative code domain power and the frequency error 2.5
Setting: Synchronizing the reference frequencies 2.6
Setting: Behaviour with deviating center frequency setting 2.6
Measurement 4: Triggered measurement of relative code domain power 2.7
Setting: Trigger offset 2.7
Setting: Behaviour with wrong PN offset 2.8
Measurement 5: Measuring the composite EVM 2.9
Measurement 6: Measuring the peak code domain error 2.10
Measurement 7: Measuring the RHO factor 2.11
Standard Test Setup 3.1
Presettings 3.2
Measuring channel power 6.2
Measuring adjacent channel power - ACLR 6.3
Signal power check – SPECTRUM EM MASK 6.11
Measuring bandwidth occupied by the signal - OCCUPIED BANDWITH 6.19
Signal statistic 6.21
Code domain measurements on cdma2000/1xEV-DV signals 6.25
Presentation of evaluations - RESULTS 6.27
Measurement configuration 6.44
Configuring the firmware application – SETTINGS 6.51
Frequency settings – *FREQ* key 6.55
Span settings – *SPAN* key 6.55
Level settings – *AMPT* key 6.56
Marker settings - *MKR* key 6.57
Changing instrument settings – *MKR→* key 6.58
Marker functions – MKR *FCTN* key 6.59
Bandwidth setting – *BW* key 6.59
Measurement control – *SWEEP* key 6.59
Measurement selection – *MEAS* key 6.59
Trigger settings – *TRIG* key 6.60
Trace settings – *TRACE* key 6.60

Display lines – *LINES* key 6.61
Measurement screen settings – *DISP* key 6.61
Storing and loading of unit data – *FILE* key 6.61
Preset of device – *PRESET* key 6.62
Calibration of device – *CAL* key 6.62
Setup of device – *SETUP* key 6.62
Printing – *HCOPY* key 6.62
CALCulate:FEED subsystem 7.1
CALCulate:LIMit:SPECtrum subsystem 7.3
CALCulate:MARKer subsystem 7.5
CALCulate:STATistics subsystem 7.7
CONFigure:CDPower subsystem 7.9
INSTrument subsystem 7.14
SENSe:CDPower subsystem 7.15
TRACe subsystem 7.20
STATus-QUEStionable:SYNC Register 7.27
Table of softkeys with assignment of IEC/IEEE bus commands 7.28
Key MEAS or Hotkey MEAS 7.28
Hot key RESULTS or Softkey CODE DOM ANALYZER 7.31
Hotkey CHAN CONF 7.32
Hotkey SETTINGS 7.33
Measuring equipment and accessories 8.1
Test procedure 8.1

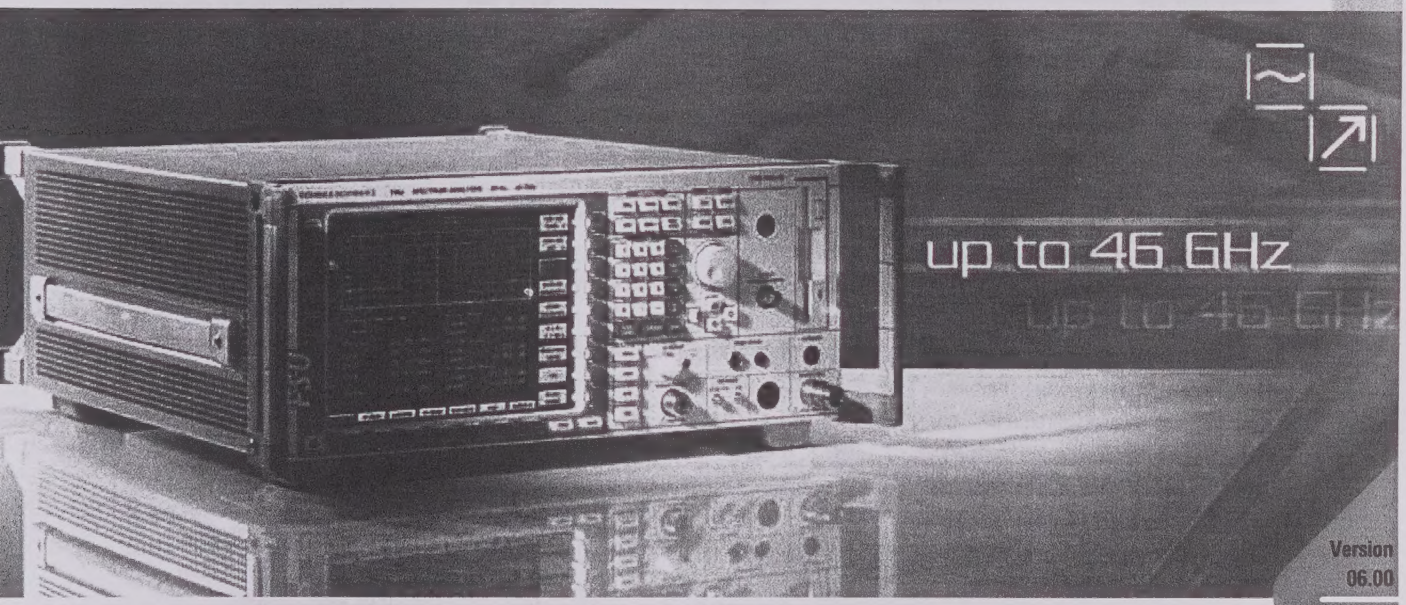
Figures

Fig. 3-1 BTS test setup 3.1
Fig. 5-1 Hot key tier with enabled application firmware R&S FS-K82 ..... 5.1
Fig. 5-2 Overview of menus in the R&S FS-K82 application firmware 5.1
Fig. 5-3 Overview of menus 5.3
Fig. 6-1 Power measurement in the 1.2288 MHz transmission channel 6.2
Fig. 6-2 Measuring adjacent channel power 6.3
Fig. 6-3 Measurement of the spectrum emission mask. 6.11
Fig. 6-4 Measuring occupied bandwidth 6.19
Fig. 6-5 CCDF of cdma2000 signal. 6.21
Fig. 6-6 Function fields of diagrams 6.28
Fig. 6-7 CDP diagram in Hadamard order 6.30
Fig. 6-8 CDP diagram in BitReverse order for the same signal 6.30
Fig. 6-9 CDEP diagram in Hadamard order 6.31
Fig. 6-10 CDEP diagram in BitReverse order for the same signal 6.32
Fig. 6-11 Composite EVM display for the case of all the channels contained in the signal being detected as active 6.33
Fig. 6-12 Composite EVM display for the case of one code channel was not detected as being active 6.33
Fig. 6-13 Peak code domain error for the case of all the channels contained in the signal being detected as active 6.34
Fig. 6-14 Peak code domain error for the case of one channel not being detected as active 6.34
Fig. 6-15 Power versus time for an occupied channel with power control 6.35
Fig. 6-16 Result summary 6.36
Fig. 6-17 Channel table 6.38
Fig. 6-18 Symbol constellation diagram 6.39
Fig. 6-19 Error vector magnitude for a PCG of a channel 6.39
Fig. 6-20 Phasor diagram for QPSK and BPSK including bit values 6.40
Fig. 6-21 Demodulated bits for a PCG of a channel 6.41
Fig. 6-22 Composite constellation diagram 6.42
Fig. 6-23 Power versus symbol for a PCG of a channel 6.42
Fig. 6-24 Table for editing a channel configuration 6.46
Fig. 6-25 Table of special channels 6.48
Fig. 6-26 Creating a new channel configuration 6.50
Fig. 6-27 Band class selection 6.51
Fig. 6-28 Marker field of diagrams 6.57

Tables

Table 2-1 Default settings of the code domain measurement after Preset 2.2
Table 4-1 Base station channel table for main branch in radio configuration 1 ..... 4.1
Table 4-2 Base station channel table for main branch in radio configuration 4 ..... 4.1
Table 4-3 Base station channel table for antenna 2 in radio configuration 4 ..... 4.2
Table 4-4 Base station test model for aggregate signal in radio configuration 4 ..... 4.2
Table 6-1 ACLR settings for band classes 0, 2, 3, 5, 9, 10, 11 and 12 ..... 6.4
Table 6-2 ACLR settings for band class 7 ..... 6.4
Table 6-3 ACLR settings for band classes 1, 4 and 8 ..... 6.4
Table 6-4 ACLR settings for band class 6 ..... 6.4
Table 6-5 Band classes 0, 2, 3, 5, 9, 10, 11 and 12 for carrier power P<28dBm 6.13
Table 6-6 Band classes 0, 2, 3, 5, 9, 10, 11 and 12 for carrier power 28 dBm <= 33 dBm 6.13
Table 6-7 Band classes 0, 2, 3, 5, 9, 10, 11 and 12 for carrier power P >= 33 dBm 6.13
Table 6-8 Band class 7 for carrier power P<28 dBm 6.14
Table 6-9 Band class 7 for carrier power 28 dBm <= P < 33 dBm 6.14
Table 6-10 Band class 7 for carrier power P>= 33 dBm 6.14
Table 6-11 Band classes 1, 4 and 8 for carrier power P<28 dBm 6.15
Table 6-12 Band classes 1, 4 and 8 for carrier power 28 dBm <= P < 33 dBm 6.16
Table 6-13 Band classes 1, 4 and 8 for carrier power P >= 33 dBm 6.16
Table 6-14 Band class 6 for all carrier power values 6.17
Table 6-15 Evaluations on screen A 6.25
Table 6-16 Evaluations on screen B 6.25
Table 6-17 Relationship between symbol rate, spreading factor and number of symbols 6.26
Table 6-18 Relationship between channel type and modulation type 6.40
Table 7-1 Meaning of bits in STATus:QUEstionable:SYNC Register 7.27
Table 9-1 Code table for base spreading factor 64 ..... 9.1
Table 9-2 Code table for base spreading factor 128 (part 1) 9.2
Table 9-3 Code table for base spreading factor 128 (part 2) 9.3

Product brochure



Version 06.00

December 2003

Spectrum Analyzer R&S®FSU

The high-end spectrum analyzer with unrivalled performance

Features

Versatile resolution filters
- Gaussian, FFT, channel, RRC

Comprehensive test routines
- TOI, OBW, CCDF
- Channel power, ACPR, multicarrier ACPR

Full choice of detectors

Optional electronic attenuator

Preamplifier up to 26 GHz

Measurement functions for following standards
- GSM/EDGE
- *Bluetooth* wireless technology
- WCDMA node B and UE
- cdma2000, cdma2000 1×EV-DO (BTS) and cdma2000 1×EV-DV (MS)

Speed

- Fast ACP test routine in time domain
- User-configurable list for fast measurements at frequencies of interest
- Up to 70 measurements/s in time domain via IEC/IEEE bus (including trace data transfer)
- Fast frequency counter with 0.1 Hz resolution in 30 ms

Unrivalled performance

Unmatched dynamic range
- TOI typ. +25 dBm
- 1 dB compression +13 dBm
- Phase noise
  typ. –123 dBc (1 Hz) at 10 kHz offset
  typ. –160 dBc (1 Hz) at 10 MHz offset
- Excellent display linearity <0.1 dB
- 84 dB ACLR/3GPP with noise correction

ROHDE&SCHWARZ

Performance surpassing all expectations ...

Milestones in spectrum analysis

The name Rohde&Schwarz has been synonymous with innovative spectrum analyzers since 1986, the unique features of which have repeatedly set standards in this technology. Examples are the analyzers of the R&S®FSE and R&S®FSIQ families.

The Spectrum Analyzer R&S®FSU is another milestone. New circuit concepts, advanced RF components, A/D converters, ASIC technology, plus extensive experience gained from a variety of applications and customer requirements – all these combine to form a solid basis on which the R&S®FSU was developed. Its unparalleled features enable the use of new test methods – to your advantage. The future-oriented concept fuses unprecedented performance with continuity. The R&S®FSU is compatible with the R&S®FSE and R&S®FSIQ, the industry standards to date. Test routines and sequences generated for the R&S®FSE or R&S®FSIQ can be used on the R&S®FSU too. The R&S®FSU family thus safeguards your investment.

The operating concept of the high-end Spectrum Analyzer R&S®FSU is the same as that of the R&S®FSP general-purpose analyzer, so these instruments offer a uniform platform for a variety of applications. The R&S®FSU even surpasses the proven excellent RF data of the R&S®FSE and R&S®FSIQ families. Measurements calling for an extremely wide dynamic range become even simpler, faster and more reliable – in development, quality management and production.

The R&S®FSU is the reference spectrum analyzer with the widest dynamic range to date.

Rohde&Schwarz innovation in spectrum analyzers

1986 **R&S®FSA** – first colour display, first spectrum analyzer to feature –154 dBm (6 Hz) displayed average noise level without the use of preamplifiers, quasi-continuously variable resolution bandwidths, phase noise optimization

1995 **R&S®FSE** – fastest analyzer

1996 **R&S®FSE** – first spectrum analyzer with RMS detector

1997 **R&S®FSE-B7** – universal vector signal analysis and spectrum analyzer capability combined for the first time

1998 **R&S®FSIQ** – first analyzer offering 75 dB dynamic range for UMTS/WCDMA ACLR measurements

1999 **R&S®FSP** – 0.5 dB total measurement uncertainty as standard, fast ACP test routines in time domain, digital channel filters, CCDF

2000 **R&S®FSP-B25** – first electronic attenuator for wear-free use in production

2001 **R&S®FSU** – 0.3 dB total measurement uncertainty, 50 MHz resolution bandwidth, +25 dBm TOI

R&S®FSU – ideal for signals requiring wide dynamic range

- TOI >20 dBm, typ. +25 dBm
- 1 dB compression: +13 dBm (0 dB RF attenuation)
- Displayed average noise level: –158 dBm (1 Hz bandwidth)
- typ. 77 dB ACLR for 3GPP, typ. 84 dB with noise correction
- HSOI typ. 55 dBm
- Phase noise: typ.–160 dBc (1 Hz) at 10 MHz carrier offset

Wealth of functions

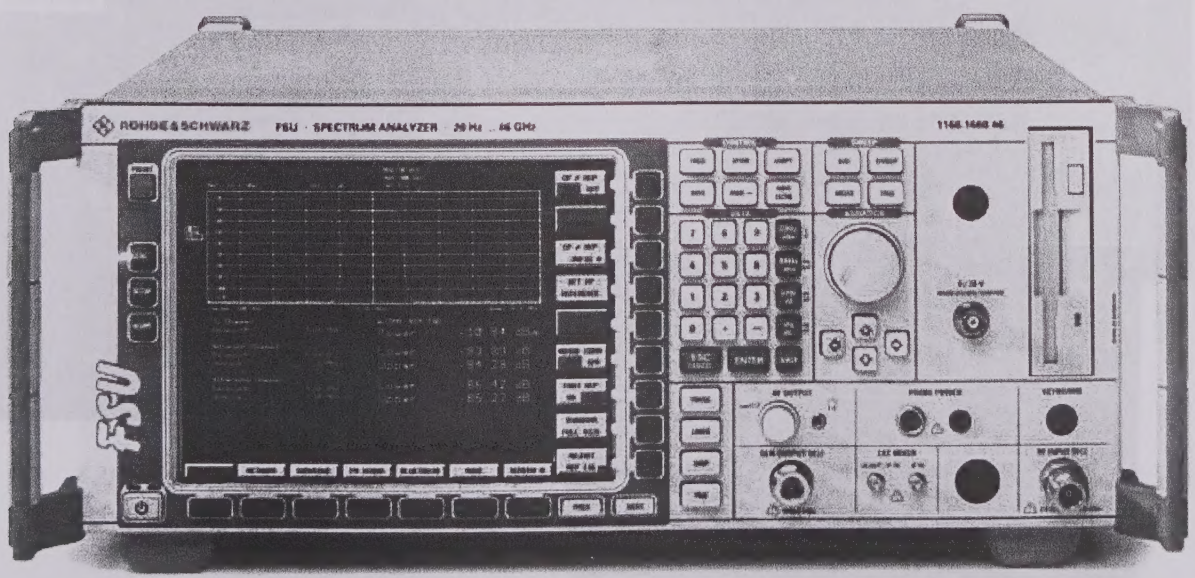
Highly selective digital filters from 10 Hz to 100 kHz	Up to 80 measurements/s in manual mode
Fast FFT filters from 1 Hz to 30 kHz	Up to 70 measurements/s on GPIB interface
Channel filters from 100 Hz to 5 MHz	SCPI-compatible GPIB command set
RRC filters	R&S®FSE/R&S®FSIQ-compatible GPIB command set
Resolution bandwidth from 1 Hz to 50 MHz	8566A/B/859x-compatible GPIB command set
QP detector and EMI bandwidths 200 Hz, 9 kHz, 120 kHz	Fast ACP measurement in time domain
2.5 ms sweep time in frequency domain	Statistical signal analysis with CCDF function
1 µs sweep time in time domain	RMS detector of 100 dB dynamic range
Number of measurement points/trace selectable between 155 and 10001	Transducer factor for correcting antenna or cable frequency responses
Time-selective spectrum analysis with gating function	Limit lines with PASS/FAIL evaluation
GPIB interface, IEEE 488.2	Peak list function for fast spurious measurement
RS-232-C serial interface, 9-pin Sub-D	2-year calibration cycle
VGA output, 15-pin Sub-D	3-year warranty[1]
PC-compatible screenshots on diskette, hard disk or USB flash memory stick	External reference from 1 MHz to 20 MHz in 1 Hz steps

[1] Except parts subject to wear and tear (e.g. attenuators)

... the R&S®FSU

Condensed specifications

	R&S®FSU3	R&S®FSU8	R&S®FSU26	R&S®FSU46
Frequency range	20 Hz to 3.6 GHz	20 Hz to 8 GHz	20 Hz to 26.5 GHz	20 Hz to 46 GHz
Reference frequency	aging: 1 x 10^{-7}/year; with option R&S®FSU-B4: 2 x 10^{-8}/year			
Spectral purity				
Phase noise	typ. –123 dBc (1 Hz) at 10 kHz from carrier			
Residual FM	1 Hz			
Sweep time				
Span ≥10 Hz	2.5 ms to 16000 s			
Span 0 Hz (zero span)	1 µs to 16000 s			
Resolution bandwidth	10 Hz to 50 MHz, FFT filter: 1 Hz to 30 kHz, channel filter, EMI bandwidth			
Video bandwidth	1 Hz to 10 MHz			
Display range	displayed average noise level to +30 dBm			
Displayed average noise level (10 Hz RBW)				
1 GHz	typ. –148 dBm	typ. –145 dBm	typ. –145 dBm	typ. –146 dBm
7 GHz	–	typ. –144 dBm	typ. –146 dBm	typ. –143 dBm
13 GHz	–	–	typ. –143 dBm	typ. –143 dBm
26 GHz	–	–	typ.–138 dBm	typ. –138 dBm
40 GHz	–	–	–	typ. –133 dBm
Displayed average noise level with preamplifier ON (R&S®FSU-B25), 1 GHz, 10 Hz RBW	–152 dBm	–152 dBm	–152 dBm	–152 dBm
Displayed average noise level with preamplifier ON (R&S®FSU-B23), 26 GHz, 10 Hz RBW	–	–	–140 dBm	–
Trace detectors	max peak, min peak, auto peak, sample, RMS, average, quasi-peak			
Total measurement error, f <3.6 GHz	0.3 dB			
Display linearity	0.1 dB (0 dB to –70 dB)			



Shorter development cycles through versatile functions ...

To handle the wide variety of measurement tasks in product development, an instrument must offer ample functionality and excellent performance in all areas of interest. The R&S®FSU fully meets these requirements.

Full choice of detectors for adaptation to a wide range of signal types (Fig. 1):

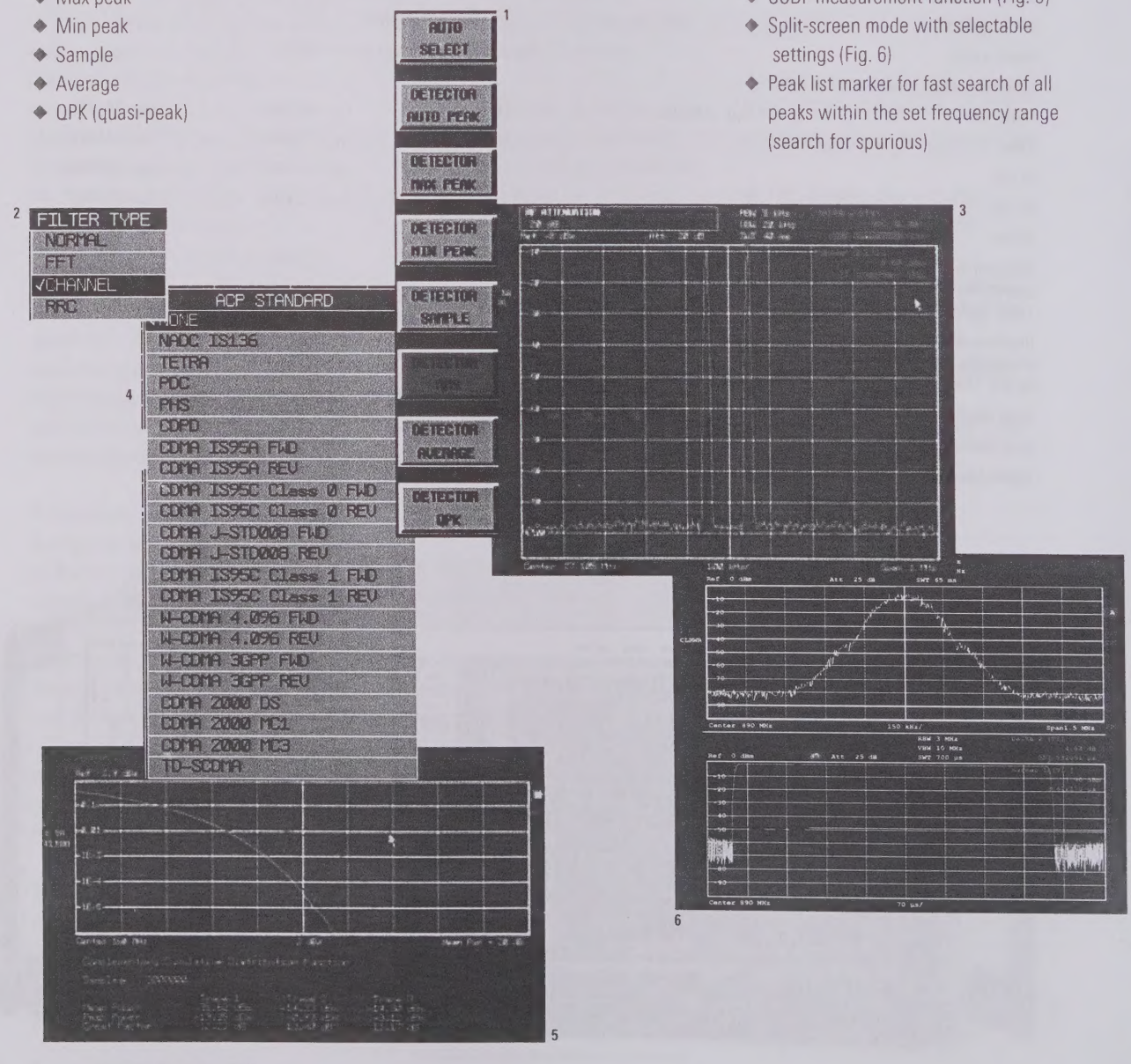
- RMS
- Auto peak
- Max peak
- Min peak
- Sample
- Average
- QPK (quasi-peak)

The most versatile resolution filter characteristics and largest bandwidth found in a spectrum analyzer:

- Standard resolution filters from 10 Hz to 50 MHz in steps of 1, 2, 3, 5
- FFT filters from 1 Hz to 30 kHz
- 32 channel filters with bandwidth from 100 Hz to 5 MHz
- RRC filters for NADC and TETRA
- EMI filters: 200 Hz, 9 kHz, 120 kHz

Full range of analysis functions:

- Time-domain power in conjunction with channel or RRC filters turn the R&S®FSU into a fully-fledged channel power meter (Fig. 2)
- TOI marker (Fig. 3)
- Noise/phase-noise marker
- Versatile channel/adjacent-channel power measurement functions with wide selection of standards, user-configurable (Fig. 4)
- CCDF measurement function (Fig. 5)
- Split-screen mode with selectable settings (Fig. 6)
- Peak list marker for fast search of all peaks within the set frequency range (search for spurious)

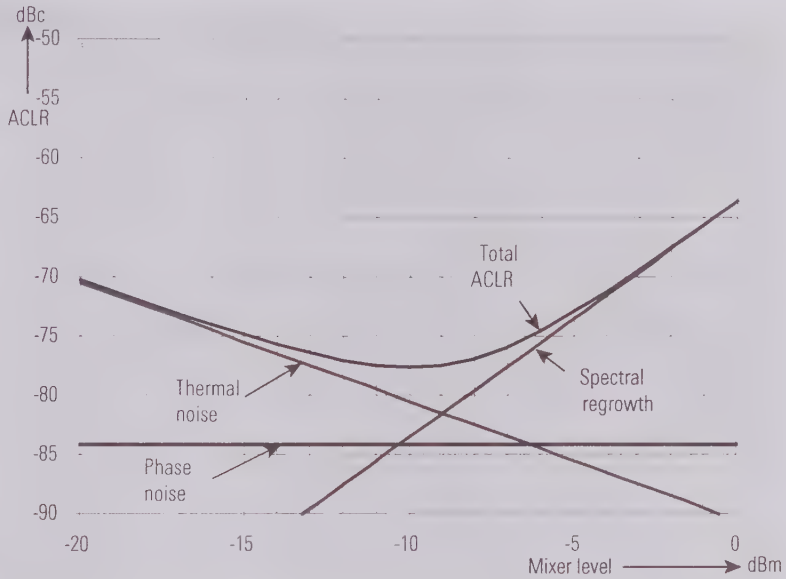


... wide dynamic range and future-proof performance

The wide dynamic range comes in handy when solving difficult measurement problems.

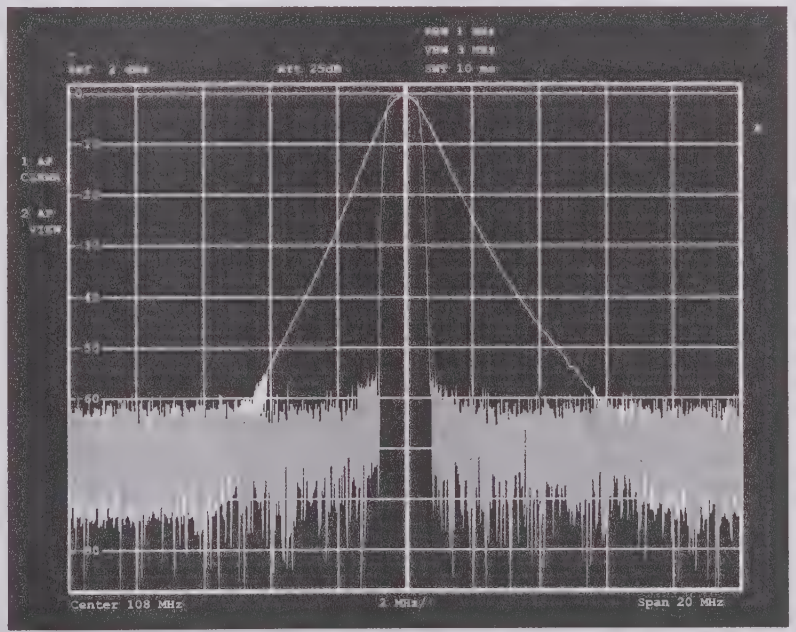
For 3GPP adjacent-channel power measurements, a figure of 77 dB ACLR – or 84 dB ACLR with noise correction – allows very good adjacent-channel power ratios to be verified and demonstrated very simply and with high accuracy. A higher-performance node B can thus be built, proving the fact.

The high harmonic second-order intercept point means optimum dynamic range for multichannel cable TV measurements.



Dynamic range of the R&S®FSU for adjacent-channel power measurement on WCDMA signal without noise correction.

Some mobile radio standards such as TETRA and IS-136 require RRC filters for power measurement such as available in the R&S®FSU. In addition, channel filters are available that support other analog and digital methods such as cdmaOne, AM/FM radio and ETS 300 113. Adjacent-channel power resulting from switching operations can also be measured using the channel filters. For conventional mobile radio standards, the R&S®FSU includes measurement routines (fast ACP) for determining the adjacent-channel power in the time domain, yielding shorter measurement times and higher reproducibility.

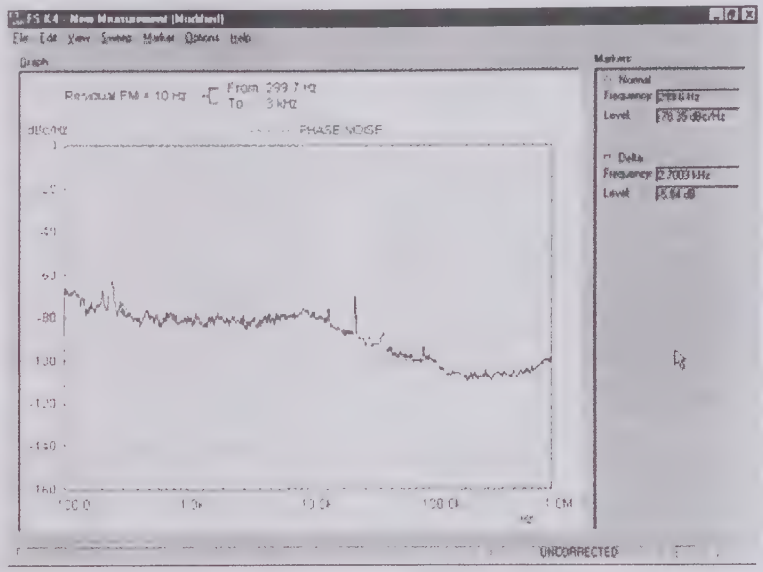


1 MHz channel filter versus normal 1 MHz resolution filter.

Shorter development cycles through versatile functions ...

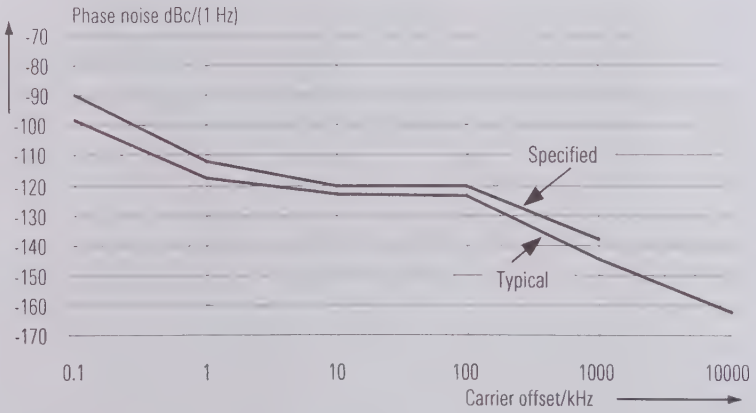
Whether in synthesizer development or frontend design, additional applications add to the R&S®FSU functionality while user-friendliness is maintained.

Phase Noise Measurement Software R&S®FS-K4 automates measurement over a complete offset frequency range and determines residual FM from the phase noise characteristic. This in conjunction with the R&S®FSU's extremely low phase noise generally does away with the need for an extra phase noise measurement system, which can be difficult to operate anyway.



Phase noise measurement with Software R&S®FS-K4.

The extremely low phase noise, particularly far away from the carrier, makes it possible to measure nonharmonics (spurious) without an additional filter even on base station signals.



SSB phase noise of the R&S®FSU.

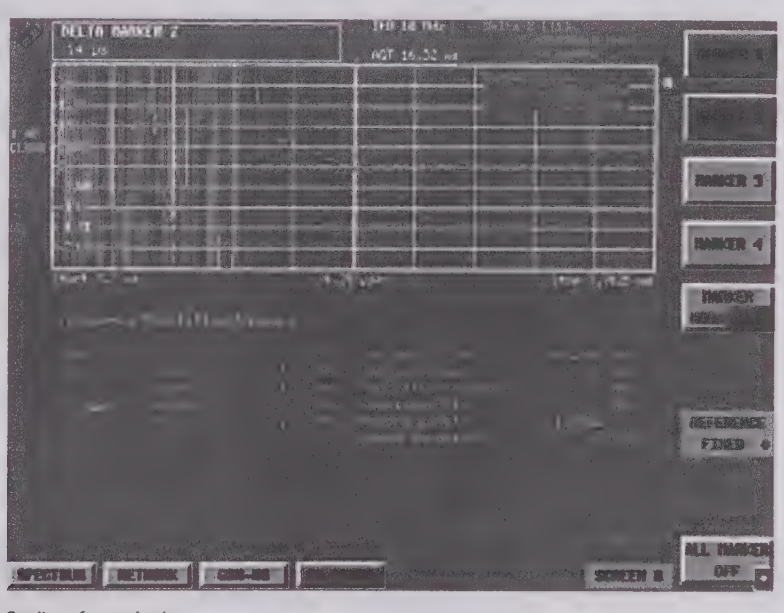
Software options and function expansions for general applications

R&S®FS-K3	Noise figure measurements (Windows software) Recommended options: Preamplifier R&S®FSU-B23, R&S®FSU-B25
R&S®FS-K4	Phase noise measurements (Windows software)
R&S®FS-K7	FM/PM measurement demodulator for general applications
R&S®FS-K9	Power sensor measurements
R&S®FS-K30	Noise figure measurements (application firmware), functions similar to R&S®FS-K3, but remote-controllable

… wide dynamic range and future-proof performance

Measuring frequency deviation after settling

The option R&S®FS-K7 adds a universal FM/PM measurement demodulator to the R&S®FSU for determining not only the frequency deviation but, for example, also the frequency settling of oscillators.

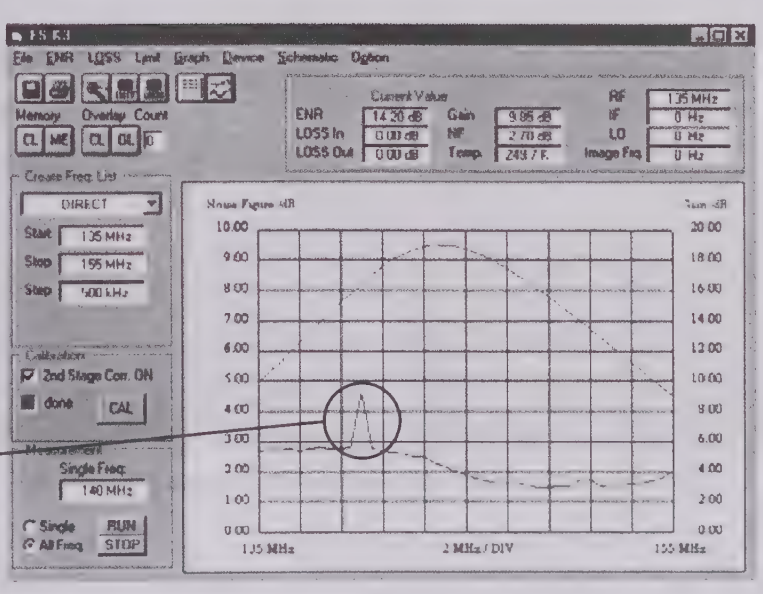


Settling of a synthesizer.

Noise figure measurement

Noise Measurement Software R&S®FS-K3 is a convenient way to determine the noise figure of amplifiers and frequency-converting UUTs throughout the R&S®FSU's frequency range, thus enabling complete documentation. The high linearity and extremely accurate power measurement routines of the R&S®FSU deliver precise and reproducible results, eliminating the need for a noise figure meter.

If the R&S®FSU3/8 is equipped with the option R&S®FSU-B25 and the R&S® FSU26 with the options R&S®FSU-B25 and -B23, a separate preamplifier is not required for measuring very low noise figures.



Noise figure measurement with Software R&S®FS-K3.

Fast and simple analysis of anomalies: the cause – spurious or RFI – can easily be traced with the basic analyzer function without additional measuring equipment.

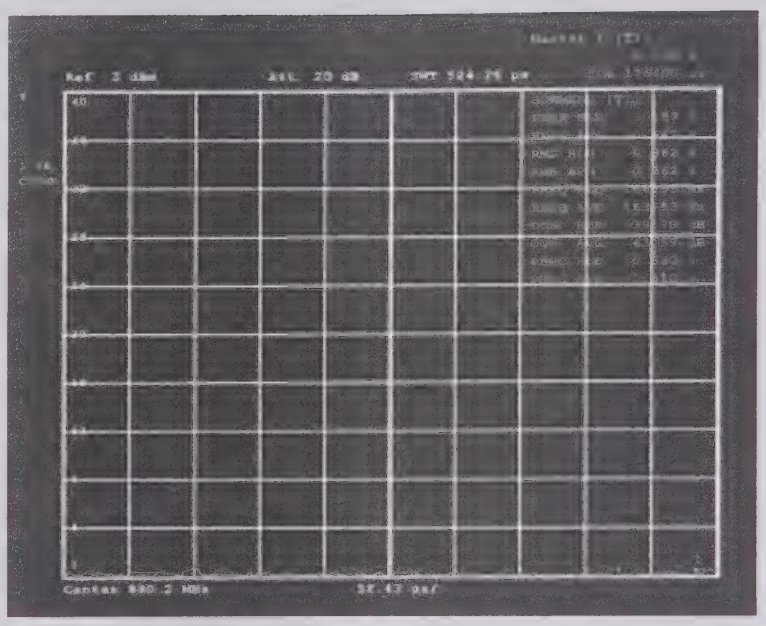
From GSM to UMTS ...

From GSM to UMTS – ready for 3G mobile radio

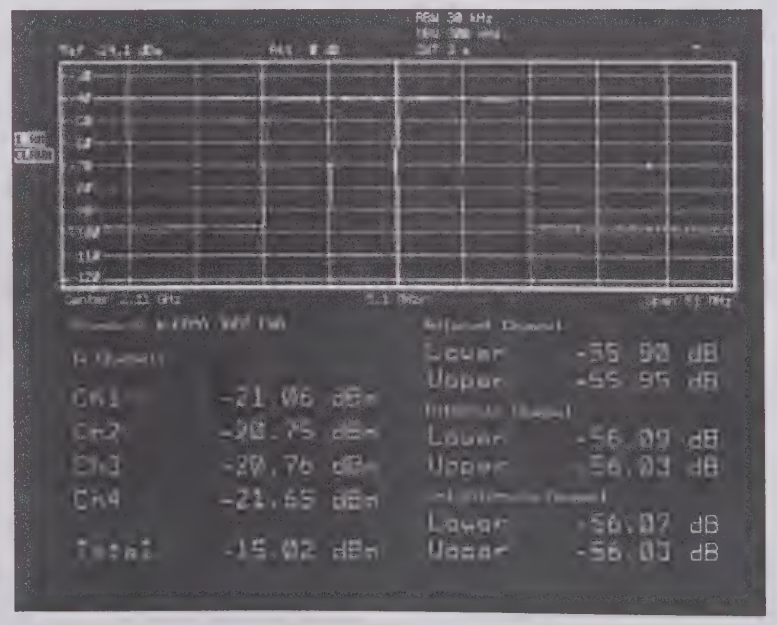
The above features plus its wide dynamic range make the R&S®FSU an ideal tool in base station development and testing. This is enhanced by excellent characteristics already incorporated in the standard unit, e.g. <0.3 dB total measurement uncertainty, gated sweep and IF power trigger.

Even in its basic version, the R&S®FSU offers the functionality and characteristics needed to develop, verify and produce 3G mobile radio systems:

- RMS detector, provided as standard in Rohde&Schwarz analyzers for many years and allowing accurate power measurements independently of signal form; 3GPP specifications stipulate RMS power measurements for most tests
- ACP measurement function for 3GPP with 3.84 MHz bandwidth RRC filter for standard-conformant adjacent-channel power measurements with a dynamic range limit of 77 dB or 84 dB
- Dedicated CCDF measurement function that determines the probability of instantaneous signal power exceeding average power; CCDF measurement is indispensable in determining optimum transmit power for CDMA signals, assuming that clipping at known, short intervals is tolerable



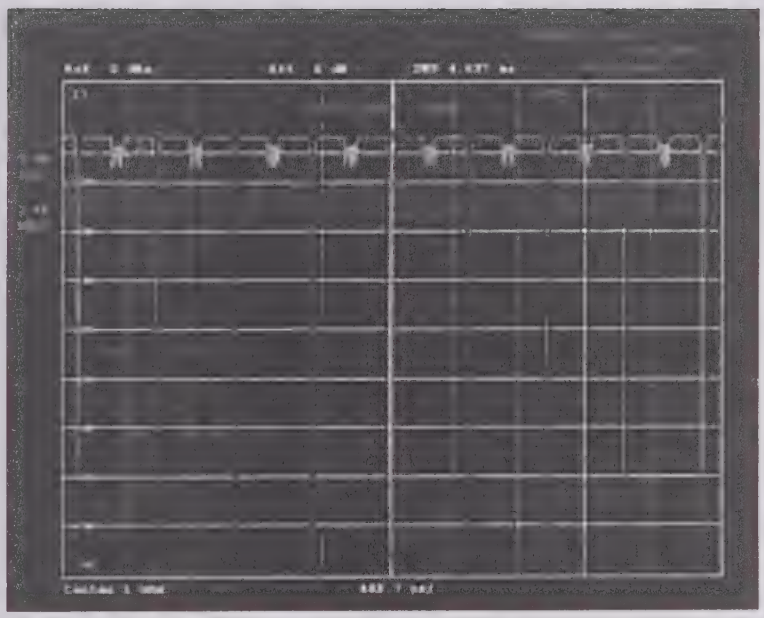
Measurement of modulation accuracy on EDGE burst.



ACP measurement with 4 channels.

In conjunction with GSM/EDGE Application Firmware R&S®FS-K5, the R&S®FSU offers complete functionality for RF and modulation measurements in GSM systems. EDGE (generation 2.5) is already included in the R&S®FS-K5 option.

- Phase/frequency error for GSM
- Modulation accuracy for EDGE with:
  - EVM and ETSI-conformant weighting filters
  - OOS
  - 95:th percentile
  - Power versus time with synchronization to midamble
  - Spectrum due to modulation
  - Spectrum due to transients



Simultaneous measurement of power versus time on an EDGE signal with eight slots.

Bluetooth® signal measurements

- Enhanced measurement functionality in line with *Bluetooth* RF Test Specification (*Bluetooth* SIG) Rev. 0.91
- Measurement functions
  - Output power
  - Adjacent channel power (ACP)
  - Modulation characteristics
  - Initial carrier frequency tolerance (ICTF)
  - Carrier frequency drift
- Simultaneous display of traces and all numerical measurement results
- Automatic limit value monitoring
- Ideal for use in development and production of *Bluetooth* modules

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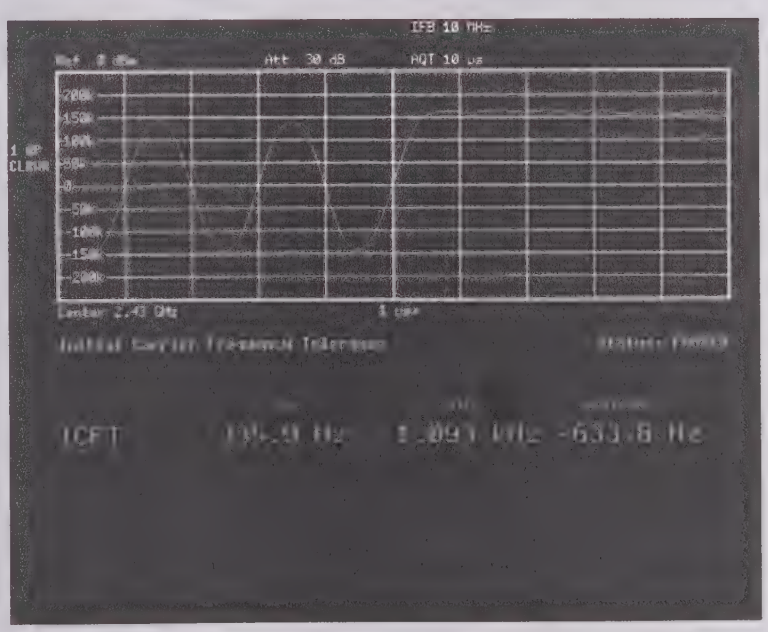
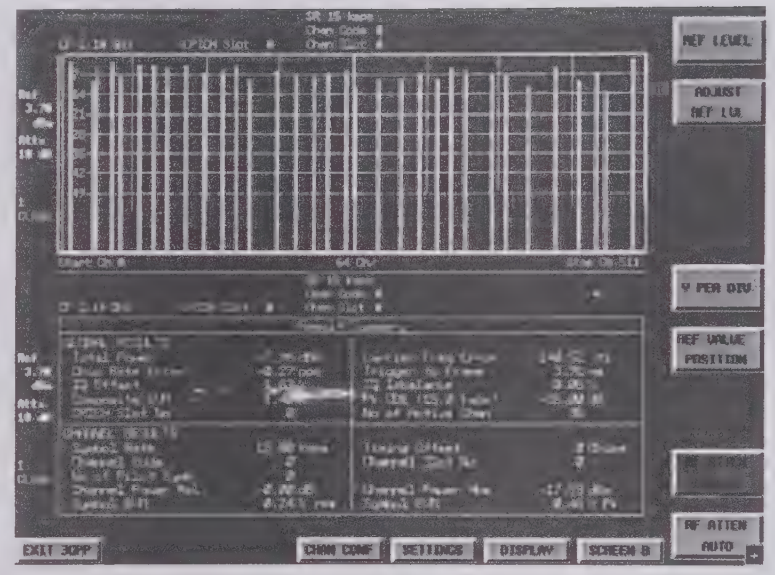


Measurement of initial carrier frequency tolerance on a Bluetooth signal with R&S®FS-K8.

... ready for 3G mobile radio

Standard 3GPP modulation and code domain power measurements

- Additional measurement functions in line with 3GPP specifications for FDD mode
- For BTS/node B signals: Application Firmware R&S®FS-K72
- For cdma2000/3GPP3 base station signals: Application Firmware R&S®FS-K82/-K84
- For UE signals: Application Firmware R&S®FS-K73
- High measurement speed of 4 s/measurement
- Code domain power and CPICH power
- Code domain power and rho (cdma2000/3GPP2)
- EVM and PCDE
- Code domain power versus slot
- EVM/code channel
- Spectrum emission mask



WCDMA code domain power measurement with the R&S®FSU and R&S®FS-K72.

Firmware options for mobile radio applications

Type	Designation and/or application
R&S®FS-K5	Modulation and spectrum measurements on GSM/EDGE base station and mobile signals
R&S®FS-K8	*Bluetooth* transmitter measurements
R&S®FS-K72	Modulation and code domain power measurements to 3GPP TS 24.141 on base station signals (node B)
R&S®FS-K73	Modulation and code domain power measurements to 3GPP TS 25.121 on mobile station signals (UE)
R&S®FS-K74	HSDPA extension for R&S®FS-K72
R&S®FS-K76	Modulation and code domain power measurements on TD-SCDMA base station signals
R&S®FS-K82	Modulation and code domain power measurements to cdma2000/3GPP2 on base station signals (also for measurements on IS-95/cdmaOne signals)
R&S®FS-K83	Modulation and code domain power measurements on cdma2000/1xEV-DV mobile station signals (UE)
R&S®FS-K84	Modulation and code domain power measurements to 1xEV-DO on base station signals

Profit from the advantages of networking

Versatile documentation and networking capabilities

The standard disk drive makes it easy to integrate results into documentation – simply save the screen contents as a BMP or WMF file and import the file into your word processing system. To process trace data, save it as an ASCII file (CSV format), which not only documents trace data but also the main instrument settings.

Make use of the advantages offered by networking

The standard LAN interface opens up versatile networking capabilities:

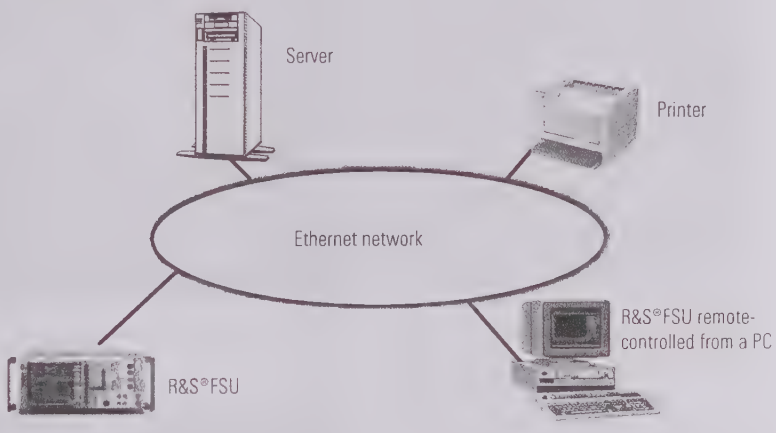
- Link to standard network (Ethernet 10/100BaseT)
- Running under Embedded XP, the R&S®FSU can be configured for network operation. Applications such as data output to a central network printer or saving results on a central server can easily be implemented. The R&S®FSU can thus be optimally matched to any work environment
- You can import screen contents directly into Word for Windows or, by using a Microsoft Excel macro, into your documentation programs and thus immediately create data sheets for your products or documents for quality assurance

The standard USB host interface allows functions such as the following:

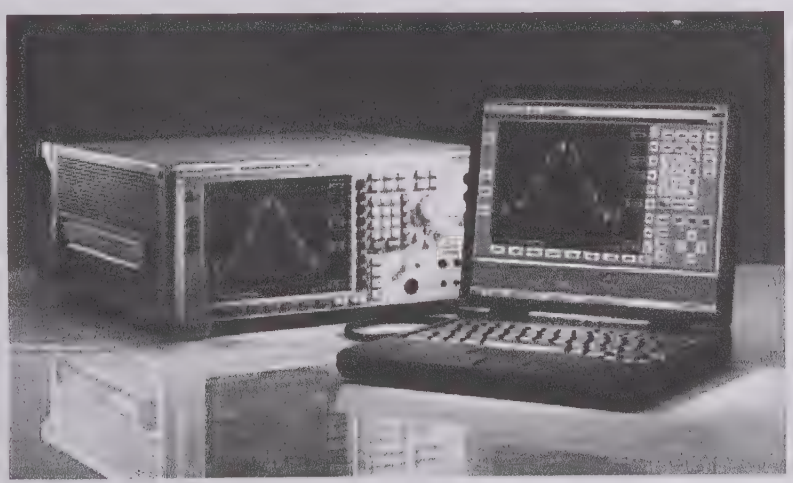
- Quick firmware update from a USB flash memory stick or a USB CD-ROM drive
- Connection of PC peripheral devices (mouse, keyboard)
- Simple file transfer, including large volumes of data via a USB flash memory stick

Remote control by Ethernet is even simpler:

- Allows mouse operation of the R&S® FSU after assigning it a TCP/IP address. All elements of the R&S®FSU screen are represented by a soft front panel function; the Windows XP remote desktop function is used to transmit the complete R&S®FSU screen to the remote PC
- Special RSIB interface: It links your application to the TCP/IP protocol and acts like an IEC/IEEE bus driver. The RSIB interface is available for Windows and the UNIX world. The R&S®FSU can be programmed via this interface just like on the familiar IEC/IEEE bus



Networked operation of the R&S®FSU.



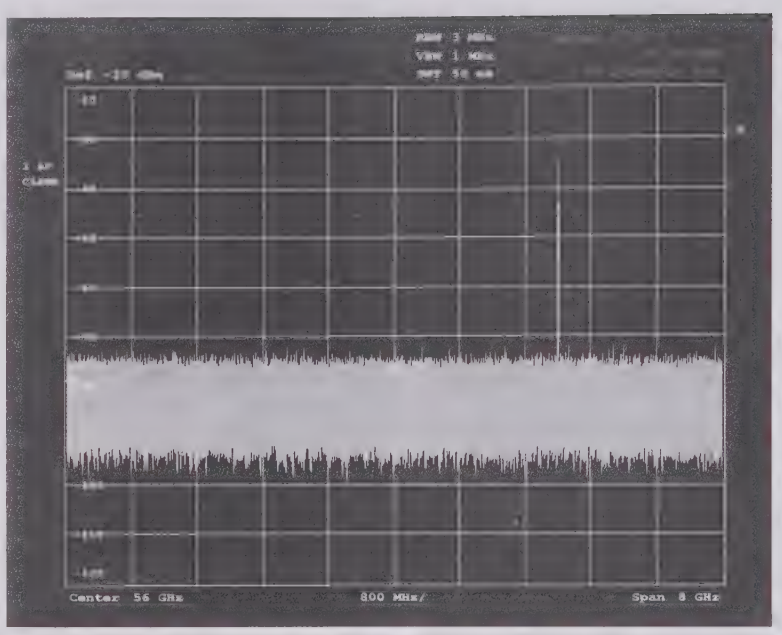
Remote control of the R&S®FSU.

Innovative solutions ...

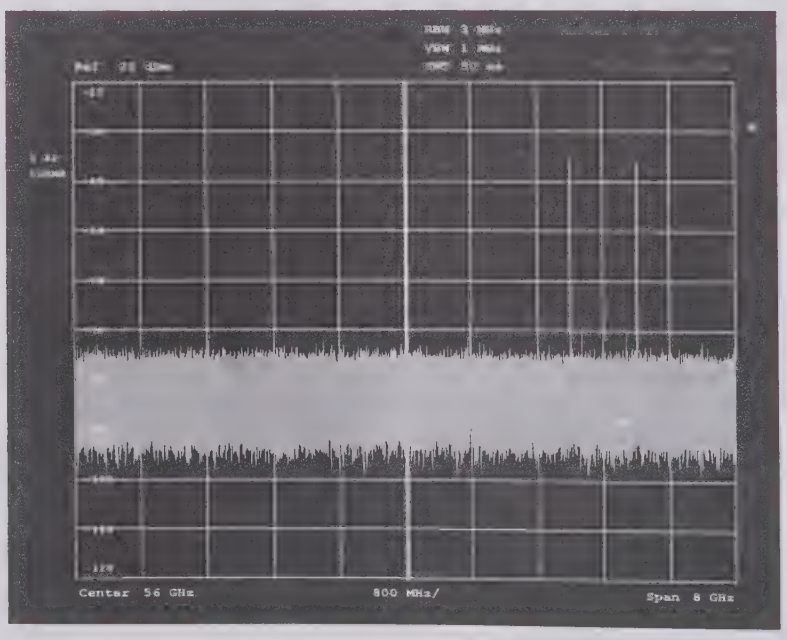
Expansion of the frequency range to 110 GHz and above

The option R&S®FSU-B21 (LO/IF ports for external mixers and external harmonic mixers, e.g. R&S®FS-Z60/-Z75/-Z90/-Z110) expands the frequency range of the R&S®FSU 26 and R&S®FSU 46 to 110 GHz and above.

- Easy-to-use software preselector that identifies and suppresses unwanted signals arising from image frequency response or reception with a harmonic number other than the one set
- Supports two- and three-port mixers that can operate with an IF of 404.4 MHz and an LO frequency range from 7 GHz to 15.5 GHz
- Maximum harmonic number that can be selected: n = 66 (or 1.022 THz)
- High LO frequency range, allowing low harmonic numbers to be used; fewer unwanted products are created and the phase noise remains lower



The software preselector suppresses image frequency response and unwanted spurious reception as can be seen by comparing the two figures.

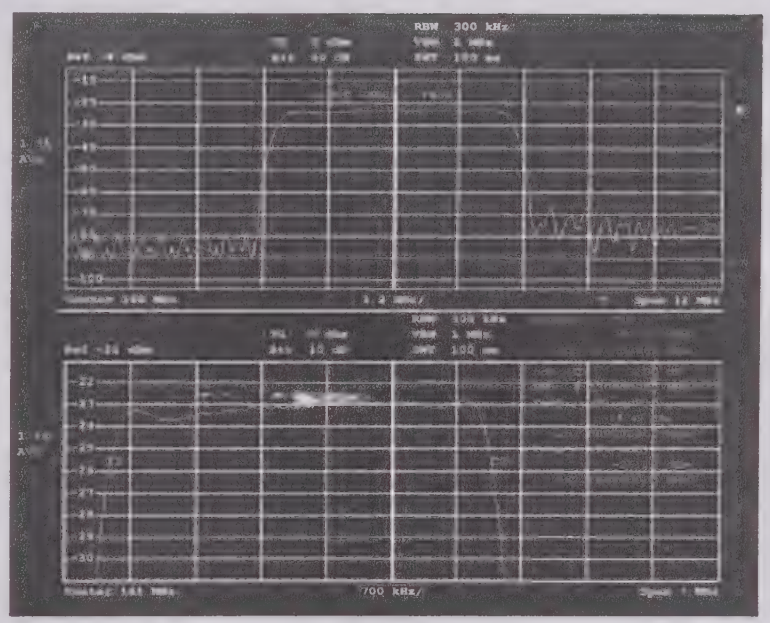


... through customized options

Scalar network analysis with wide dynamic range

The options R&S®FSU-B9 (internal tracking generator up to 3.6 GHz) and R&S® FSP-B10 (external generator control) turn the R&S®FSU signal generators into scalar network analyzers. Through selective measurement, the gain, frequency response, insertion loss and return loss can be measured with a wide dynamic range without being influenced by harmonics or spurious from the generator. The internal Tracking Generator R&S® FSU-B9 can be implemented in all R&S® FSU models and covers the frequency range from 100 kHz to 3.6 GHz; a frequency offset for measuring frequency-converting modules of ±150 MHz can be set. The tracking generator can be broadband-modulated using an external I/Q baseband signal.

The option R&S®FSP-B10 uses conventional RF signal generators as an external tracking source, controlled via GPIB or a TTL bus. Together with microwave generators such as the R&S®SMR or R&S®SMP, the frequency range can be expanded up to 46 GHz for scalar transmission, loss and reflection measurements.



This solution covers the functions of the internal tracking generator:

- Normalization with interpolation including for reflection measurements with open and short
- Automatic bandwidth measurement via the "n dB down" function
- Tolerance characteristics with PASS/FAIL evaluation

Certified Quality System ISO 9001 DQS REG. NO 1954 QM

Certified Environmental System ISO 14001

What can we do ...

Short test cycles, high throughput

The R&S®FSU is just the right instrument for this purpose. Fast data transfer on the IEC/IEEE bus or an Ethernet LAN plus intelligent routines optimized for speed make for very short measurement times:

- Fast ACP: for the major mobile radio standards with high reproducibility and accuracy
- List mode: combined measurement of various parameters at a single command
- Fast time domain power measurement using channel or RRC filters
- Up to 70 measurements/s in zero span via IEC/IEEE bus including trace data transfer
- Fast-sweeping FFT filters for spurious measurement at low levels
- Fast frequency counter: 0.1 Hz resolution for a measurement time of <30 ms

Downtime and repair time cut to a minimum

No limited lifetime of mechanical attenuators due to high throughput
The optional electronic attenuator R&S® FSU-B25 with 25 dB setting range does away with any mechanical switching – so the R&S®FSU's high accuracy is maintained without any early failure. A two-year calibration cycle minimizes downtime for instrument calibration.

Spurious emission measurements without notch filter
The R&S®FSU is the ideal choice for this type of measurement, even for tests on GSM base stations. The extremely low phase noise and high 1 dB compression point of the R&S®FSU enable direct measurements without the use of extra automatic or manually tuned notch filters. This eliminates possible sources of error and makes measurements simpler and more reliable. It also enhances the reliability of your test system.

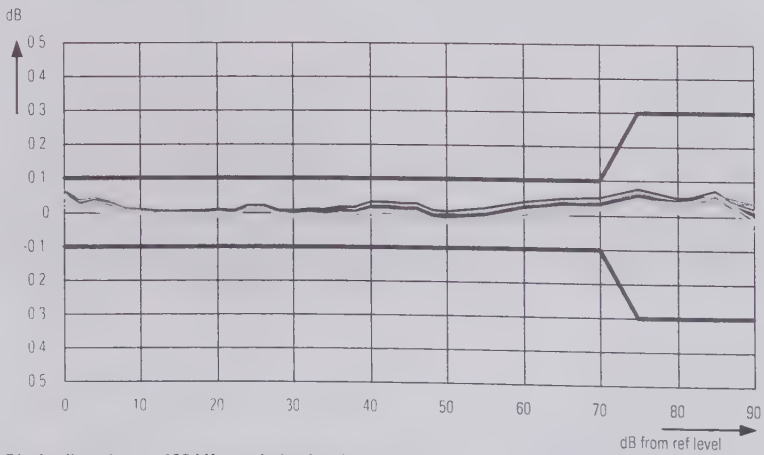
Existing programs for the R&S®FSE, R&S®FSIQ or R&S®FSP can be used on the R&S®FSU
The R&S®FSU complies with SCPI conventions and is IEC/IEEE-bus-compatible with respect to the R&S®FSE and R&S® FSIQ. These instruments can in most cases be directly replaced with only minor, if any, changes to the software. If changes have to be made, they affect only those program parts that concern the speed-optimized measurement routines of the R&S®FSU.

External frequency standards
The R&S®FSU accepts signals between 1 MHz and 20 MHz in steps of 1 Hz.

Higher production yield
Enhanced measurement accuracy makes for higher production yield. The safety margins that usually compensate for the measurement uncertainty of test systems can be reduced, thus increasing the accept (passed) region. Given the same spread of results, more products will pass the test. The R&S®FSU helps you to boost your production yield due to a total measurement uncertainty of <0.3 dB (2σ).

LAN interface

With the aid of the optional LAN Interface R&S®FSU-B16, the R&S®FSU can be connected to common networks such as 100BaseT so that functions such as file logging on network drives or documentation of measurement results via a network printer are available. In addition, the R&S®FSU can be remote-controlled via a LAN. This yields a clear speed advantage over the IEC/IEEE bus in particular for the transmission of large data blocks.



Display linearity at ≤100 kHz resolution bandwidth (measured on 30 instruments).

... to boost your production yield?

859x/8566-compatible IEC/IEEE bus command set

In many applications, existing test software is to be used in automatic test systems with new devices. For this reason, the R&S®FSU is provided as standard with an IEC/IEEE bus command set that is compatible not only with the R&S®FSEx/ R&S®FSIQ family but also with the spectrum analyzers of the 859x/8566 series.

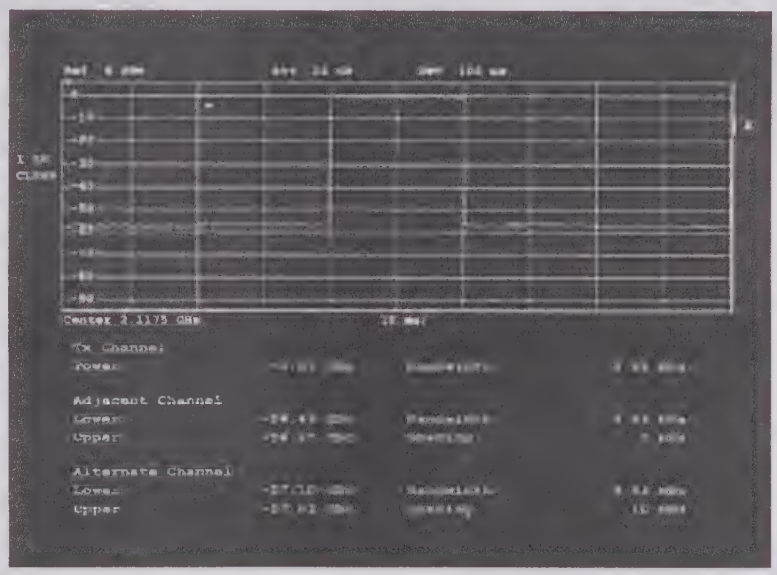
It was of utmost importance to achieve maximum compatibility in order to minimize the effort required to change from one to the other:

- Approx. 175 commands in IEEE488.2 format (incl. CF, AT, ST)
- The most important commands in IEEE488-1 format (8566A, for exclusive use only)
- Selectable presets
- Selectable trace format

The IEC/IEEE bus commands in IEEE488.2 format can be used together with the R&S®FSU command set, so that it is possible to enhance and complete available software by using the innovative instrument functions of the R&S®FSU (such as list mode, channel filters) without having to redesign the test software.

	Sweeps/s Span 10 MHz, sweep time 2.5 ms	**Sweeps/s** Span 0 Hz, sweep time 100 µs
Binary IEEE754 format	50	70

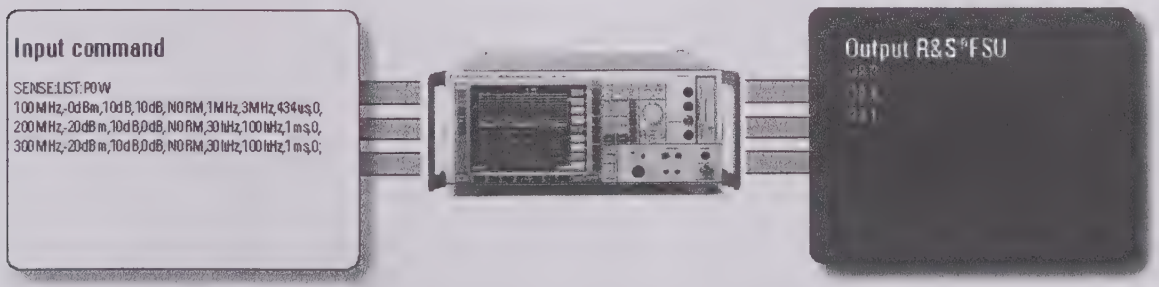
Measurement speed on GPIB interface.
Settings: display off, default coupling, single trace, 625 points.



Measurement of adjacent-channel power versus time: fast ACP.

With 80 measurements/s in manual mode, minimum sweep time of 2.5 ms and 1 µs zero span as standard, the R&S® FSU is ideal for time-critical applications.

The highly selective, fast-sweeping digital filters featuring "analog response" allow measurements on pulsed signals as well as use of the built-in frequency counter.



Remote control of the R&S®FSU via IEC/IEEE bus in list mode cuts down on measurement time.

Ordering information

Order designation	Type	Order No.
Spectrum Analyzer, 20 Hz to 3.6 GHz	R&S®FSU3	1166.1660.03
Spectrum Analyzer, 20 Hz to 8 GHz	R&S®FSU8	1166.1660.08
Spectrum Analyzer, 20 Hz to 26.5 GHz	R&S®FSU26	1166.1660.26
Spectrum Analyzer, 20 Hz to 46 GHz	R&S®FSU46	1166.1660.46

Accessories supplied
Power cable, operating manual, service manual.
R&S®FSU26: test port adapter with 3.5 mm female (1021.0512.00) and N female (1021.0535.00) connector
R&S®FSU46: test port adapter with K female (1036.4790.00) and N female (1036.4777.00) connector

Options

Order designation	Type	Order No.
Options		
Low-Aging OXCO	R&S®FSU-B4	1144.9000.02
Tracking Generator, 100 kHz to 3.6 GHz	R&S®FSU-B9	1142.8994.02
External Generator Control	R&S®FSP-B10	1129.7246.02
Attenuator for Tracking Generator	R&S®FSU-B12	1142.9349.02
Removable Hard Disk	R&S®FSU-B18[1] [2]	1145.0242.04
Second Hard Disk for R&S®FSU-B18	R&S®FSU-B19[2]	1145.0394.04
Extended Environmental Specification	R&S®FSU-B20[1] [3]	1155.1606.08
LO/IF Ports for External Mixers	R&S®FSU-B21	1157.1090.02
RF Preamplifier, 3.6 GHz to 26 GHz, for R&S®FSU26	R&S®FSU-B23[1] [4] [5]	1157.0907.02
Electronic Attenuator, 0 dB to 30 dB, and 20 dB preamplifier	R&S®FSU-B25	1144.9298.02
Software		
Noise Measurement Software	R&S®FS-K3	1057.3028.02
Phase Noise Measurement Software	R&S®FS-K4	1108.0088.02
GSM/EDGE Application Firmware	R&S®FS-K5	1141.1496.02
FM/PM Measurement Demodulator	R&S®FS-K7	1141.1796.02
Application Firmware for *Bluetooth* Measurements	R&S®FS-K8	1157.2568.02
Power Sensor Measurements	R&S®FS-K9	1157.3006.02
Application Firmware for Noise Figure and Gain Measurements	R&S®FS-K30	1300.6508.02
3GPP BTS/Node B FDD Application Firmware	R&S®FS-K72	1154.7000.02
3GPP UE FDD Application Firmware	R&S®FS-K73	1154.7252.02
3GPP HSDPA BTS Application Firmware	R&S®FS-K74	1300.7156.02
3GPP TD-SCDMA Application Firmware	R&S®FS-K76	1300.7291.02
cdma2000 BTS Application Firmware	R&S®FS-K82	1157.2316.02
cmda2000 1xEV-DV MS Application Firmware	R&S®FS-K83	1157.2416.02
cdma2000 1xEV-DO BTS Application Firmware	R&S®FS-K84	1157.2851.02
Service Kit	R&S®FSU-Z1	1145.0042.02

[1] Factory installation only.
[2] Not with R&S®FSU-B20.
[3] Not with R&S®FSU-B18/-B19.
[4] Not for retrofit.
[5] R&S®FSU-B25 required

For specifications see PD 0758.0016.22
and www.rohde-schwarz.com
(search term: FSU)

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Printed in Germany (Pe as)

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Contents of the Application Firmware R&S FS-K82 Software Manual

This software manual contains information on the operation of the Spectrum Analyzer R&S FSU, R&S FSP or Signal Analyzer R&S FSQ configured with the Application Firmware R&S FS-K82. It includes a description of the menus and the remote-control commands for the cdma2000/1xEV-DV base station test application firmware.
All other aspects of analyzer operation can be taken from the operating manual of the analyzer.

The software manual of the application firmware consists of the data sheet and 10 chapters:

The **data sheet**	informs on the guaranteed and typical specifications and the firmware characteristics
Chapter 1	describes how to enable the application firmware.
Chapter 2	describes typical examples of measurements by means of tests.
Chapter 3	describes the measurement setup for base station tests.
Chapter 4	describes the predefined channel tables.
Chapter 5	gives a schematic view of the control menus.
Chapter 6	contains a detailed description of all functions for base station tests as a reference for manual operation. The chapter also presents a list of IEC/IEEE bus commands associated with each function.
Chapter 7	describes all remote-control commands defined for the application firmware. A table containing the IEC/IEEE bus commands assigned to the softkeys are given at the end of the chapter.
Chapter 8	describes the performance test
Chapter 9	contains code tables in Hadamard and BitReverse order
Chapter 10	contains definitions relating to measured quantities of the code domain measurement
Chapter 11	contains the index of this software manual.

cdma2000 Base Station Test - Application Firmware R&S FS-K82

When configured with the Application Firmware R&S FS-K82, the analyzer performs code domain power measurements on forward link signals (base station) on the basis of the 3GPP2 Standard (Third Generation Partnership Project 2).

The **"Recommended Minimum Performance Standard for cdma2000 Spread Spectrum Base Stations Release C"**, version C.S0010-C dated May 2002, is taken as a basis.
This Standard has been approved by the following authority with the specified designation:

- TIA: TIA/EIA-97-E (also known as IS-97-E)

When the cdma2000 specification is mentioned in the document, these standards are meant.
The application firmware supports radio configurations 1 to 5. This means that all radio configurations with a single carrier (1X) are supported. Accordingly, IS95A/B signals conforming to radio configurations 1&2 can also be measured with this application firmware. Channels and modulation types of the 1xEV-DV enhancement are supported as well. In addition to the measurements called for by the cdma2000 Standard in the code domain, the application firmware features measurements in the spectral range such as channel power, adjacent channel power, assigned bandwidth and spectrum emission mask with predefined settings.

1 Installing and Enabling the Application Firmware

Installation

If the Application Firmware R&S FS-K82 has not been installed on the unit, a firmware update has to be performed. This has already been done in the case of instalment at the factory.

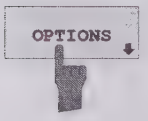
A prerequisit to install the application firmware is that an appropriate basic firmware is installed on the analyzer. Refer to the release notes of the current Application Firmware R&S FS-K82 for the compatible version.

If the basic firmware has to be updated, the firmware update with the floppy disks containing the basic firmware has to be performed, this is done by choosing *SETUP → NEXT → FIRMWARE UPDATE.*
When the correct basic software has been installed, the firmware update for the firmware application can be started from the floppy disks containing the Firmware Application R&S FS-K82 by choosing the same options - *SETUP → NEXT → FIRMWARE UPDATE.*
After the application firmware has been installed, it has to be enabled as described below.

Enabling

The Application Firmware R&S FS-K82 is enabled on the *SETUP → GENERAL SETUP* menu by entering a keyword. The keyword is supplied with the application firmware. If the application is installed at the factory it will also be enabled.

GENERAL SETUP menu:



The OPTIONS softkey opens a submenu in which the keywords for the application firmware can be entered. The available applications are displayed in a table, which is opened when you enter the submenu.

The *INSTALL OPTION* softkey enables entry of the keyword for an application firmware.

You can enter one or more keywords in the entry field. If the keyword is valid, the message *OPTION KEY OK* is displayed and the application firmware is entered in the *FIRMWARE OPTIONS* table.

If a keyword is invalid, the message *OPTION KEY INVALID* is displayed.

If the version of the application firmware and the version of the basic firmware are not compatible, a corresponding message is issued. In this instance, follow the instructions contained in the above chapter, "Installation".

2 Getting Started

The following chapter explains fundamental cdma2000 base station tests using a measurement setup with the signal generator SMIQ as the device under test. It describes how operating and measuring errors can be avoided by means of correct default settings.
The measurement screen is presented in Chapter 0 for the different measurements.

Attention is drawn to important settings exemplifying how to avoid measurement errors during measurements. The correct setting is followed by a demonstration of the effect of an incorrect setting. The following measurements are performed:

- Measurement 1: Measuring the signal spectrum
- Measurement 2: Measuring the spectrum emission mask
- Measurement 3: Measuring the relative code domain power and the frequency error
  -Setting: Center frequency
- Measurement 4: Triggered measurement of relative code domain power
  -Setting: Trigger offset
  -Setting: PN offset of base station
- Measurement 5: Measuring the composite EVM
- Measurement 6: Measuring the peak code domain error
- Measurement 7: Measuring the RHO factor

As the cdma2000 application firmware also supports the IS95 Standard, the examples are performed on an IS95 signal.

Measurements are performed with the following units and accessories:

- Spectrum analyzer R&S FSU, R&S FSP or Signal analyzer R&S FSQ with application firmware R&S FS-K82 base station test for cdma2000.
- Vector signal generator SMIQ with option B11 data generator / B20 modulation coder and B42 cdmaOne (IS95) and SMIQ-Z5 PARDATA BNC ADAPTER for external trigger.
- 1 coaxial cable, 50 Ω, approximately 1 m, N connector
- 2 coaxial cables, 50 Ω, approximately 1 m, BNC connector

- The following conventions apply to displaying settings on the analyzer:

[***<Key>***]	Press a key on the front panel such as ***[SPAN]***
[<SOFTKEY>]	Press a softkey such as *[MARKER -> PEAK]*
[<nn unit>]	Enter a value and terminate by entering the unit such as *[12 kHz]*

- The following conventions apply to displaying settings on the SMIQ:

[***<Key>***]	Press a key on the front panel such as ***[FREQ]***
<MENU>	Choose a menu, parameter or a setting such as *DIGITAL STD.* The menu level is identified by indenting.
<nn unit>	Enter a value and terminate by entering the unit such as *12 kHz*

Default settings in cdma2000 BTS mMode

In the default setting after PRESET, the analyzer is in SPECTRUM mode. The following default settings of the code domain measurement are not enabled until cdma2000 BTS mode is selected by means of the hot key CDMA2k BS.

Table 2-1 Default settings of the code domain measurement after Preset

Parameter	Setting
Digital standard	CDMA 2000 MC1 (where MC1 stands for Multi-carrier 1 and thus describes cdma2000 1X, i.e. a single carrier)
Band class	Band class 0 (800 MHz band)
Sweep	CONTINUOUS
CDP mode	CODE CHAN AUTOSEARCH
Trigger setting	FREE RUN
Trigger offset	0 s
PN offset	0 Chips
Threshold value	-60 dB
Code number	0
PCG number	0
Capture length	3 PCGs (where PCG stands for Power Control Group)
Code order	Hadamard
Antenna diversity	OFF
Evaluation	Screen A: CODE PWR RELATIVE Screen B: RESULT SUMMARY

Measurement 1: Measuring the signal power

Measurement of the spectrum gives an overview of the cdma2000 signal and the spurious emissions close to the carrier.

Test setup

➢ Connect the RF output of SMIQ to the RF input of the analyzer (coaxial cable with N connectors).

Setting on SMIQ:

[PRESET]
[LEVEL: *0 dBm]*
[FREQ: *878.49 MHz]*
DIGITAL STD
IS95
STATE: *ON*

Setting on analyzer:

[PRESET]
[FREQUENCY: *878.49 MHz]*
[AMPT: *0 dBm]*
[CDMA2k BS]
[MEAS: *POWER]*

Measurement on analyzer: The following is displayed:

- The spectrum of the cdma2000 signal
- The signal channel power within the 1.2288 MHz channel bandwidth

Measurement 2: Measuring the spectrum emission mask

The cdma2000 specification calls for a measurement that monitors compliance with a spectral mask over a range of at least ±4.0MHz around the cdma2000 carrier. To assess the power emissions within the specified range, the signal power is measured with a 30kHz filter. The resulting trace is compared with a limit line as defined in the cdma2000 standard. The limit lines are automaticaly selected as a function of the used band class.

Test setup

➢ Connect the RF output of SMIQ to the RF input of the analyzer (coaxial cable with N connectors).

Setting on SMIQ:

[PRESET]	
[LEVEL:	*0 dBm]*
[FREQ:	*878.49 MHz]*
DIGITAL STD	
IS95	
STATE:	*ON*

Setting on analyzer:

[PRESET]	*Band class 0 is thus selected*
[FREQUENCY:	*878.49 MHz]*
[AMPT:	*0 dBm]*
[CDMA2k BS]	
[MEAS:	*SPECTRUM EM MASK]*

Measurement on analyzer: The following is displayed:

- The spectrum of the cdma2000 signal
- The limit line defined in the standard
- Information on limit line violations (passed/failed)

Measurement 3: Measuring the relative code domain power and the frequency error

A code domain power measurement on a test model (having 9 channels) is shown in the following. The basic parameters of the CDP measurements, which allows an analysis of the signal, are changed one after the other from values adapted to the measurement signal to non-adapted values to demonstrate the ensuing effects.

Setting on SMIQ:

- Connect the RF output of SMIQ to the RF input of the analyzer.
- Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)

Setting on SMIQ:

[PRESET]
[LEVEL: *0 dBm]*
[FREQ: *878.49 MHz]*
DIGITAL STD
IS95
STATE: *ON*

Setting on analyzer:

[PRESET]
[FREQUENCY: *878.49 MHz]*
[AMPT: *10 dBm]*
[CDMA2k BS]

Measurement on analyzer: The following is displayed:

Screen A: Signal code domain power (test model with 9 channels)

Screen B: Numeric results of CDP measurement including the frequency error

Setting: Synchronizing the reference frequencies

Synchronization of the transmitter and receiver to the same reference frequency reduces the frequency error.

Test setup
➢ Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)

Setting on SMIQ:
As for measurement 3

Setting on analyzer:
As for measurement 3, plus
[SETUP: *REFERENCE EXT]*

Measurement on analyzer:
Screen B: Frequency error: The displayed frequency error should be < 10 Hz.

The reference frequencies of the analyzer and device under test should be synchronized.

Setting: Behaviour with deviating center frequency setting

In the following setting, the behaviour of the DUT and analyzer on a deviating center frequency setting is shown.

Setting on SMIQ:
➢ Tune the center frequency of the signal generator in 0.1-kHz steps and observe the analyzer screen while doing so:

Measurement on analyzer:
- Up to a frequency error of roughly 1.5 kHz a CDP measurement on the analyzer is still possible. There is no apparent difference in measurement accuracy of the CDP measurement up to this frequency error.
- Above a 1.5 kHz frequency offset, the probability of incorrect synchronization increases. The 'SYNC FAILED' message appears.
- Above a frequency error of roughly 2 kHz, a CDP measurement cannot be performed. The 'SYNC FAILED' message appears

Setting on SMIQ:
➢ Reset the signal generator center frequency to 878.49 MHz:
[FREQ: *878.49 MHz]*

The analyzer center frequency should not deviate from the DUT frequency by more than 1.5 kHz.

Measurement 4: Triggered measurement of relative code domain power

If the code domain power measurement is performed without external triggering, a section of the test signal is recorded at an arbitrary point of time and the firmware attempts to detect the start of a power control group (PCG). To detect this start, all possibilities of the PN sequence location have to be tested in Free Run mode. This requires computing time. This computing time can be reduced by using an external (frame) trigger and entering the correct PN offset. If the search range for the start of the power control group and the PN offset are known then fewer possibilities have to be tested. This increases the measurement speed.

Test setup

- Connect the RF output of SMIQ to the RF input of the analyzer
- Connect the reference frequencies (refer to measurement 2)
- Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Setting on SMIQ: As for measurement 3

Setting on analyzer: As for measurement 3, plus
***[TRIG:** EXTERN]*

Measurement on analyzer: The following is displayed:
Screen A: Code domain power of signal
Screen B: Numeric results of CDP measurement

Trg to frame: Offset between trigger event and start of the PCG

The repetition rate of the measurement increases compared with measurement without an external trigger.

Setting: Trigger offset

A delay between the trigger event and the start of the PCG can be compensated for, by changing the trigger offset.

Setting on analyzer: As for measurement 3, plus
[TRIG:]
[TRIG OFFSET 100 µs]

Measurement on analyzer: The parameter "Trg to Frame" in the numeric results table (screen B) changes:
Trg to Frame -100 µs

A trigger offset compensates analog delays of the trigger event.

Setting: Behaviour with wrong PN offset

A valid CDP measurement can only be performed if the PN offset set on the analyzer are the same as that of the transmit signal.

Setting on SMIQ:	*As for measurement 3*
Setting on analyzer:	Set PN offset to the new value:
	[SETTINGS: PN-OFFSET 200]
Measurement on analyzer:	The 'SYNC FAILED' message appears.
Setting on analyzer:	Set PN offset to the new value:
	[SETTINGS: PN-OFFSET 0]
Measurement on analyzer:	The CDP display shows the test model again.

The setting of the PN offset on the analyzer must agree with the PN offset of the signal to be measured.
The TRG TO FRAME value of the result summary is only correct if the PN offset agrees!

Measurement 5: Measuring the composite EVM

Composite EVM is the measurement of the mean squared error of the overall signal required by the cdma2000 specification.
The instrument generated an ideal reference signal from the demodulated data. The test signal and the reference signal are then compared with each other. The squared deviation produces the composite EVM measurement.

Test setup

- Connect the RF output of SMIQ to the RF input of the analyzer (coaxial cable with N connectors)
- Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)
- Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Setting on SMIQ:

[PRESET]
[LEVEL: *0 dBm]*
[FREQ: *878.49 MHz]*
DIGITAL STD
IS95
STATE: ON

Setting on analyzer:

[PRESET]
[FREQUENCY: *878.49 MHz]*
[AMPT: *10 dBm]*
[CDMA2k BS]
[TRIG *EXTERN]*
[RESULTS *COMPOSITE EVM]*

Measurement on analyzer: The following is displayed:

Screen A: Code domain power of signal

Screen B: Composite EVM (EVM for total signal)

Measurement 6: Measuring the peak code domain error

For the peak code domain error measurement, the insturment generates an ideal reference signal from the demodulated data. The test signal and the reference signal are compared with each other; the difference between the two signals is projected to the class of the base spreading factor. The peak code domain error measurement is obtained by summing the symbols of each PCG of the difference signal and searching for the maximum error code.

Test setup

- Connect the RF output of SMIQ to the RF input of the analyzer (coaxial cable with N connectors)
- Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)
- Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Setting on SMIQ:

[PRESET]	
[LEVEL:	*0 dBm]*
[FREQ:	*878.49 MHz]*
DIGITAL STD	
IS95	
STATE:	*ON*

Setting on analyzer:

[PRESET]	
[FREQUENCY:	*878.49 MHz]*
[AMPT:	*0 dBm]*
[CDMA2k BS]	
[TRIG	*EXTERN]*
[RESULTS	*PEAK CODE DOMAIN ERR]*

Measurement on analyzer: The following is displayed:

Screen A: Code domain power of signal

Screen B: Peak code domain error (for base spreading factor with the default setting value of 64)

Measurement 7: Measuring the RHO factor

A measurement of the RHO factor is shown in the following. The quality parameter RHO is required to be measured on a signal that only contains the pilot channel.

Setting on SMIQ:

- Connect the RF output of SMIQ to the RF input of the analyzer.
- Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)

Setting on SMIQ:

[PRESET]
[LEVEL: *0 dBm]*
[FREQ: *878.49 MHz]*
DIGITAL STD
IS95
STATE: *ON*
On the list of channels, except pilot code 0, set to STATE OFF. This means that only the pilot channel is available in the signal.

Setting on analyzer:

[PRESET]
[FREQUENCY: *878.49 MHz]*
[AMPT: *10 dBm]*
[CDMA2k BS]

Measurement on analyzer: The following is displayed:

Screen A: Signal code domain power
(Only the pilot from 0.64)

Screen B: Numeric results of CDP measurement including the RHO factor

3 Test Setup for Base Station Tests

Note:

Before taking the unit into operation, make sure that

- *The housing covers are in place and their screws have been tightened*
- *The ventilation slits are free*
- *No signal voltage levels above the permissible limits are applied to the inputs*
- *The outputs of the unit are not overloaded or wrongly connected*

Failure to comply with the above points may result in damage to the unit.

This chapter describes the default settings of the analyzer for operation as a cdma2000 base station tester. A condition that has to be met before measurements can start is that the analyzer is correctly configured and supplied with power, as described in Chapter 1 of the operating manual for the basic unit. Furthermore, the Application Firmware R&S FS-K82 must be enabled. Installation and enabling of the application firmware are described in Chapter 1 of this software manual.

Standard Test Setup

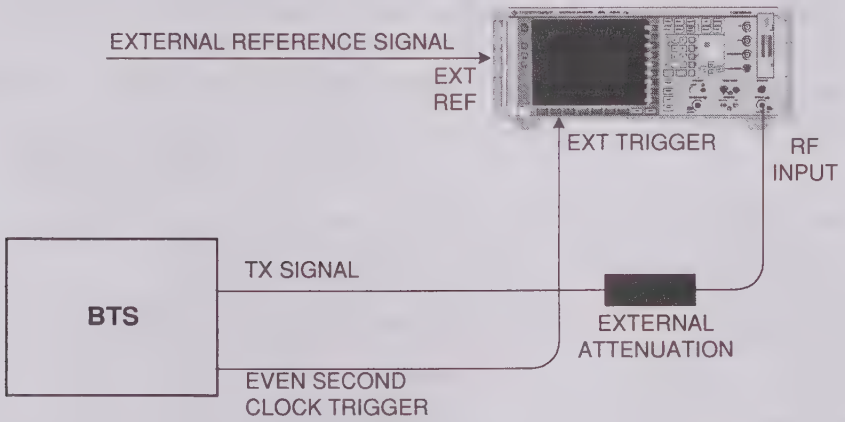


Fig. 3-1 BTS test setup

- Connect the antenna output (or TX output) of the base station to the RF input of the analyzer by means of a power attenuator exhibiting suitable attenuation.

  The following values for external attenuation are recommended to ensure that the RF input of the analyzer is protected and the sensitivity of the unit is not reduced too much:

Maximum power	Recommended external attenuation
≥ 55 to 60 dBm	35 to 40 dB
≥ 50 to 55 dBm	30 to 35 dB
≥ 45 to 50 dBm	25 to 30 dB
≥ 40 to 45 dBm	20 to 25 dB
≥ 35 to 40 dBm	15 to 20 dB
≥ 30 to 35 dBm	10 to 15 dB
≥ 25 to 30 dBm	5 to 10 dB
≥ 20 to 25 dBm	0 to 5 dB
20 dBm	0 dB

- For signal measurements at the output of two-port networks, connect the reference frequency of the signal source to the rear reference input of the analyzer (EXT REF IN/OUT).
- To ensure that the error limits specified in the cdma2000 specification for frequency measurements on base stations are met, the analyzer must be operated with an external frequency reference. A rubidium frequency standard can be used as a reference source, for example.
- If the base station has a trigger output, connect the trigger output of the base station to the rear trigger input of the analyzer (*EXT TRIG GATE*).

Presettings

- Enter the external attenuation. ***[AMPT] [NEXT]*** *[REF LVL OFFSET].*
- Enter the reference level. ***[AMPT]***
- Enter the center frequency. ***[FREQUENCY]***
- Set the trigger. ***[TRIG]***
- If used, enable the external reference. ***[SETUP]*** *[REF: EXT]*
- Select the standard and the desired measurement. *[CDMA2k BS] [RESULTS]*
- Set the PN offset *[SETTINGS] [PN OFFSET]*

4 Predefined Channel Tables

By default, the application firmware works in the Automatic Channel Search mode (softkey *CODE CHAN AUTOSEARCH*). However, there is also the option of using predefined channel tables and taking the code domain analysis as a basis. To do this, select the channel table and enable the predefined search mode (*CODE CHAN PREDEFINED* softkey). In accordance with the cdma2000 specification, different channel tables have already been defined. These tables are listed below. The standard does not specify a channel number for the data channels. If you wish to use channels other than those in the predefined channel tables of the firmware application, you may copy the original tables and adapt the channels in the copy. (Refer to the *CHAN CONF* hot key on page 6.44)

Channel table with PICH/SYNC/PCH and 6 data channels called **MPC_RC1**. (Base Station **M**ain **P**ath 6 **C**hannels Radio **C**onfiguration 1).

Table 4-1 Base station channel table for main branch in radio configuration 1

Channel type	Number of channels	Radio configuration	Code channel (Walsh Code.SF)
PICH	1	-	0.64
SYNC	1	-	32.64
PCH	1	-	1.64
CHAN	6	1 1 1 1 1 1	9.64 10.64 11.64 15.64 17.64 25.64

Channel table with PICH/SYNC/PCH and 6 data channels called **MPC_RC4**. (Base Station **M**ain **P**ath 6 **C**hannels **R**adio **C**onfiguration 4).

Table 4-2 Base station channel table for main branch in radio configuration 4

Channel type	Number of channels	Radio configuration	Code channel (Walsh Code.SF)
PICH	1	-	0.64
SYNC	1	-	32.64
PCH	1	-	1.64
CHAN	6	4 4 4 4 4 4	9.128 10.128 11.128 15.128 17.128 25.128

Channel table with PICH/SYNC/PCH and 6 data channels called **TDC_RC4**. (Base Station **T**ransmit **D**iversity **P**ath 6 **C**hannels **R**adio **C**onfiguration 4).

Table 4-3 Base station channel table for antenna 2 in radio configuration 4

Channel type	Number of channels	Radio configuration	Code channel (Walsh Code.SF)
TDPICH	1	-	16.128
SYNC	1	-	32.64
PCH	1	-	1.64
CHAN	6	4 4 4 4 4 4	9.128 10.128 11.128 15.128 17.128 25.128

In addition to these models specified in the standard, a further model is defined in the firmware:

Channel table with PICH/TDPICH/SYNC/PCH and 6 data channels called **BPC_RC4**. (Base Station **B**oth **P**aths 6 **C**hannels **R**adio **C**onfiguration 4).

Table 4-4 Base station test model for aggregate signal in radio configuration 4

Channel type	Number of channels	Radio configuration	Code channel (Walsh Code.SF)
PICH	1	-	0.64
TDPICH	1	-	16.128
SYNC	1	-	32.64
PCH	1	-	1.64
CHAN	6	4 4 4 4 4 4	9.128 10.128 11.128 15.128 17.128 25.128

Channel table similar to MPC_RC4, but additionally with a PACKET DATA CONTROL CHANNEL and 11 PACKET DATA CHANNELs called **DV** due to the 1xEV-DV enhancement.

Channel type	Number of channels	Radio configuration	Code channel (Walsh Code.SF)
PICH	1	-	0.64
SYNC	1	-	32.64
PCH	1	-	1.64
PDCCH	1	-	5.64
PDCH	11	10 10 10 10 10 10 10 10 10 10 10	31.32 15.32 23.32 7.32 27.32 11.32 19.32 3.32 30.32 14.32 22.32
CHAN	6	4 4 4 4 4 4	9.128 10.128 12.128 16.128 17.128 25.128

For further information on the channel table defaults refer to the *CHAN CONF* hot key.

The channel abbreviations are defined in Chapter 10.

5 Menu Overview

The Application Firmware R&S FS-K82 (cdma2000/1xEV-DV base station tests) adds RF measurements and code domain power measurements for the cdma2000 forward link mobile radio standard to the analyzer including 1xEV-DV.

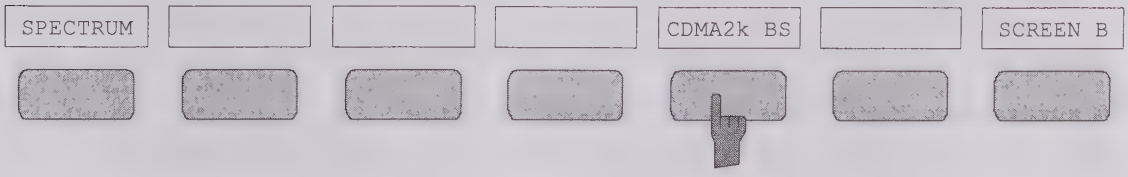


Fig. 5-1 Hot key tier with enabled application firmware R&S FS-K82

After entering the application firmware by pressing the hot key *CDMA2k BS* (2k stands for two thousand, i.e. cdma2000) a new hot key tier is displayed at the bottom edge of the screen and the code domain analyzer is selected and started.

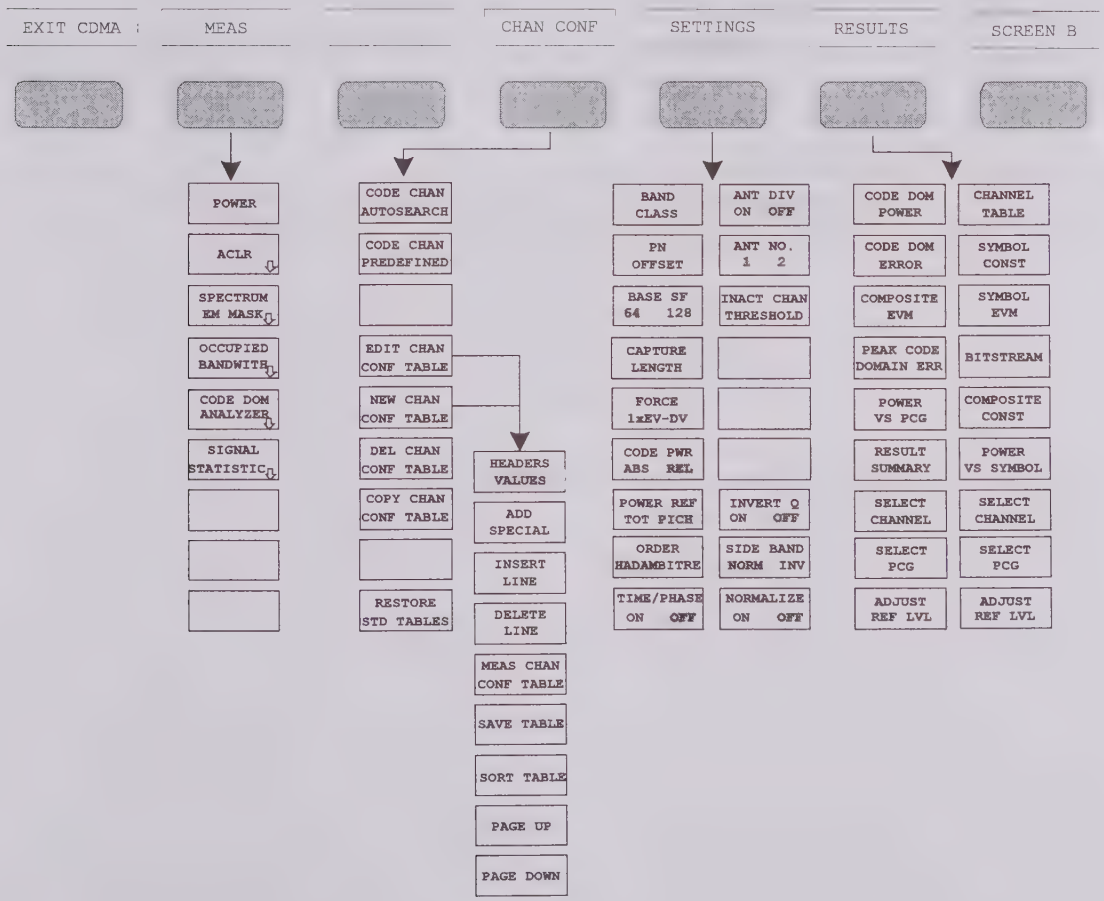


Fig. 5-2 Overview of menus in the R&S FS-K82 application firmware

There are different evaluations for the code domain analyzer. They can be selected by means of the *RESULTS* hot key. The *SETTINGS* hot key can be used to configure the application firmware. The PN offset

of the base station or the band class can be set in this menu, for example. The *CHAN CONF* hot key is used to set Channel Search mode for the code domain analyzer. Furthermore, the user can also define his own channel tables.
The MEAS hot key is identical to the MEAS key (on the right of the front panel) and is used to select the different RF measurements or the code domain analyzer.
Selection of the *CHAN CONF* or *RESULTS* hot key automatically results in switching to the code domain analyzer.
Pressing the *EXIT CDMA* hot key results in exiting from R&S FS-K82. The hot key tier of the basic unit is displayed again and the analyzer goes to SPECTRUM, the default mode.

Transition from SPECTRUM mode to the application firmware:

The following user-specific settings are not modified so that the adaptation to the device under test is preserved:

Reference Level + Rev Level Offset
Center Frequency + Frequency Offset
Input Attenuation + Mixer Level

The following user-specific settings are transferred as follows:

External trigger sources are preserved, while all other trigger sources result in Free Run mode. Additional trigger settings are preserved.

Transition from the application firmware to SPECTRUM mode:

The following user-specific settings are not modified so that the adaptation to the device under test is preserved:

Reference Level + Rev Level Offset
Center Frequency + Frequency Offset
Input Attenuation + Mixer Level

The following user-specific settings are transferred as follows:

The trigger source is switched to FREE RUN and an analyzer frequency sweep is set with the SPAN equal to the double center frequency, or the maximum possible span, so that the center frequency remains unchanged at any event.

The measurements available in R&S FS-K82 can be selected by means of the *MEAS* hot key or the *MEAS* key:

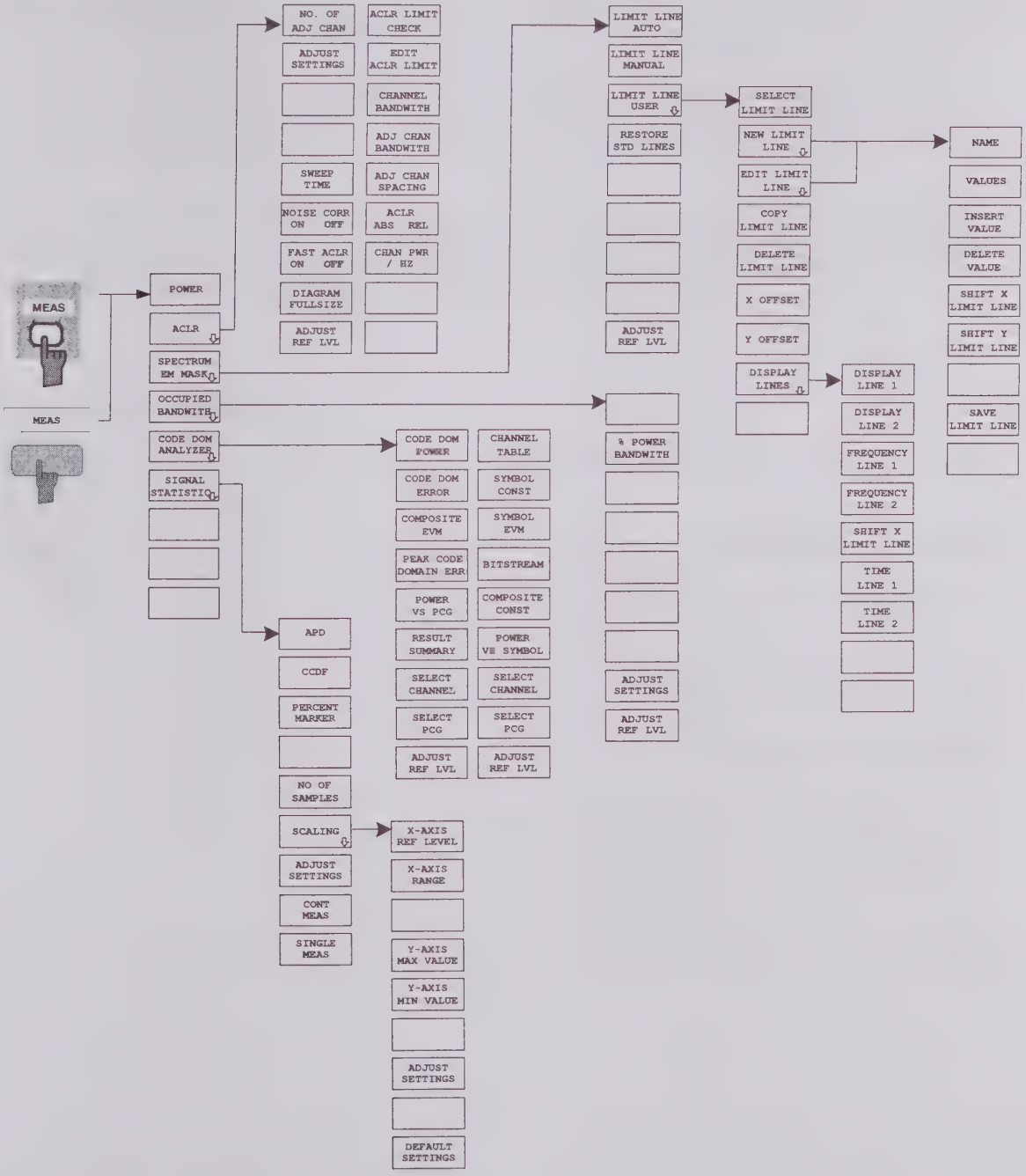


Fig. 5-3 Overview of menus

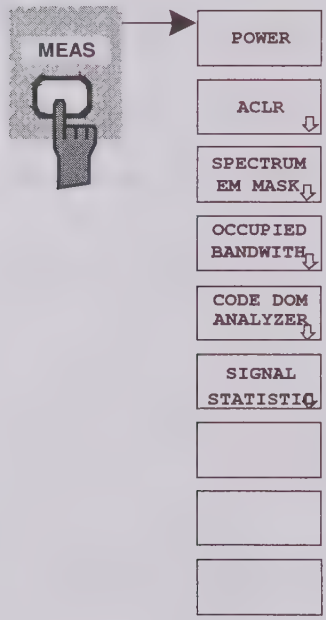
6 Configuration of cdma2000 Measurements

The most important measurements of a cdma2000 base station can be selected by means of the *MEAS* hot key and the *MEAS* key. They will be explained below on the basis of the softkey functions.

The *CODE DOM ANALYZER* softkey activates the code domain analyzer and takes you to the submenus for selecting the evaluations. Changing the assignment of the hot key tier during transition to the application ensures that the most important parameters of the code domain analyzer can be directly accessed on the hot key tier.

The softkeys *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH*, and *SIGNAL STATISTIC* enable base station measurements with predefined settings, which are performed in SPECTRUM mode of the basic unit. The measurements are performed with the parameters specified in the cdma2000 specification. The user can modify the settings at a later stage.

MEAS key or *MEAS* hot keys

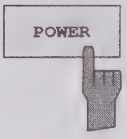


The *MEAS* hot key or the *MEAS* key opens a submenu for selecting the measurements:

- *POWER* enables the channel power measurement with defined default values in SPECTRUM mode.
- *ACLR* enables the adjacent channel power measurement with defined default values in *SPECTRUM* mode.
- *SPECTRUM EM MASK* performs a comparison of the signal power in different carrier offset ranges with the maximum values specified in the cdma2000 specification.
- *OCCUPIED BANDWIDTH* enables measurement of the bandwidth assigned to the signal.
- *CODE DOM ANALYZER* enables the code domain analyzer and opens another menu for choosing the evaluation type. All other menus of the analyzer are adapted to the functions of the code domain analyzer mode. The code domain analyzer is described in a separate chapter starting on page 6.25.
- *SIGNAL STATISTIC* evaluates the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).

Measuring channel power

MEAS key or *MEAS* hot key



The *POWER* softkey enables measurement of the channel power of the cdma2000 signal.

The analyzer measures the RF signal power in a 1.2288 MHz bandwidth. The power is calculated by summation of the values at the trace points. The bandwidth and the associated channel power are displayed beneath the measurement screen.

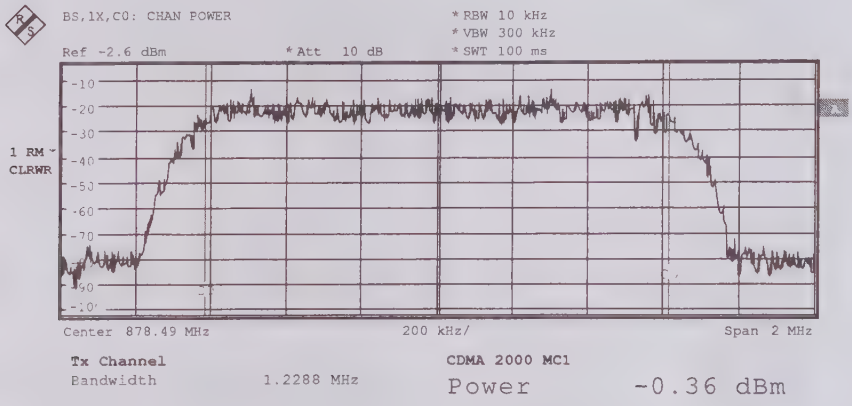


Fig. 6-1 Power measurement in the 1.2288 MHz transmission channel

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting: Level parameters Center Frequency + Frequency Offset All trigger settings	
ADJACENT CHAN POWER	ON
ACP STANDARD	cdma2000 MC1 (MC1 simply stands for multi-carrier, i.e. a single carrier)
NO OF ADJ CHANNELS	0 (main channel only)
FREQUENCY SPAN	2 MHz

Departing from this setting, the analyzer can be operated in all the functions it features in SPECTRUM mode, i.e. all measurement parameters can be adapted to a specific measurement.

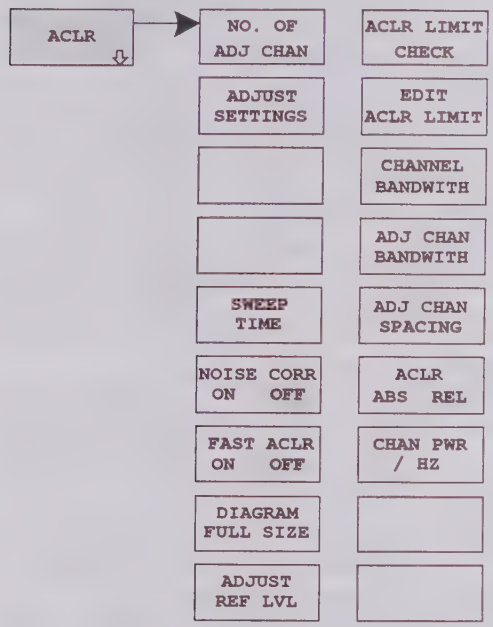
To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:
Level parameters
RBW, VBW
Sweep time

IEC bus command: `:CONFigure:CDPower:MEASurement POWer`

Query of results: `:CALCulate:MARKer:FUNCtion:POWer:RESult? CPOWer`

Measuring adjacent channel power - ACLR

MEAS key or *MEAS* hot key



The *ACLR* (Adjacent Channel Leakage Power Ratio) softkey enables measurement of the adjacent channel power. The settings and limits are taken from the spurious emissions measurement defined in the cdma2000 specification.

The analyzer measures the power of the useful channel and of the adjacent channels on the left and right sides. In the default setting, only two adjacent channels are taken into account. Measurement results are displayed beneath the measurement screen.

The limits depend on the band class setting (BAND CLASS softkey).

The ACLR limit check can be enabled or disabled by means of the ACLR LIMIT CHECK softkey.

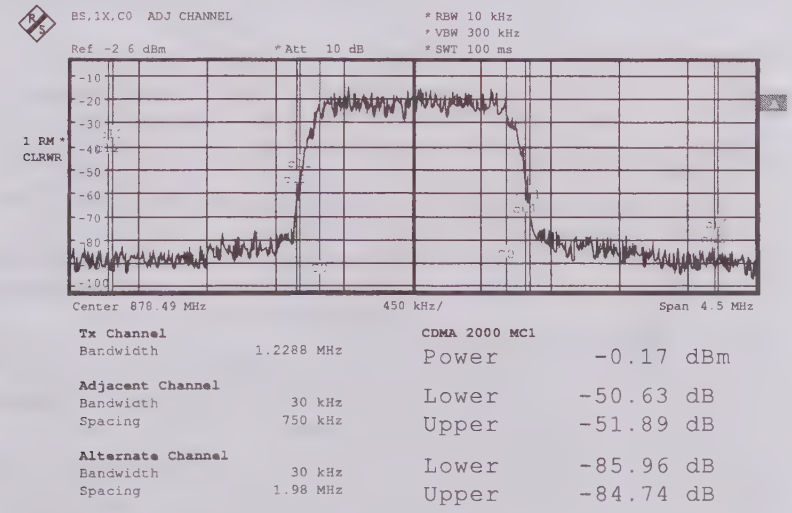


Fig. 6-2 Measuring adjacent channel power

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting: Level parameters Center Frequency + Frequency Offset All trigger settings	
ADJACENT CHAN POWER	ON
ACP STANDARD	cdma2000 MC1
NO OF ADJ. CHANNELS	2

Table 6-1 ACLR settings for band classes 0, 2, 3, 5, 9, 10, 11 and 12

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	750 kHz	30 kHz	-45 dBc	none
Alternate	1.98 MHz	30 kHz	-60 dBc	-27 dBm
Alternate2	4.00 MHz	30 kHz	-60 dBc	-27 dBm

Table 6-2 ACLR settings for band class 7

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	750 kHz	30 kHz	-45 dBc	none
Alternate	1.98 MHz	30 kHz	-60 dBc	-27 dBm
Alternate2	4.00 MHz	30 kHz	none	-39.2 dBm

Table 6-3 ACLR settings for band classes 1, 4 and 8

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	885 kHz	30 kHz	-45 dBc	none
Alternate	1.25 MHz	30 kHz	-45 dBc	-9 dBm
Alternate2	1.98 MHz	30 kHz	-55 dBc	-22 dBm

Table 6-4 ACLR settings for band class 6

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	885 kHz	30 kHz	-45 dBc	none
Alternate	1.25 MHz	30 kHz	none	-13 dBm
Alternate2	1.45 MHz	30 kHz	none	-13 dBm

Departing from this setting, the analyzer can be operated in all the functions it features in SPECTRUM mode, i.e. all measurement parameters can be adapted to a specific measurement.

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:

- Level parameters
- RBW, VBW
- Sweep time
- SPAN
- NO OF ADJ. CHANNELS
- FAST ACLR MODUS

IEC/IEEE bus command: `:CONFigure:CDPower:MEASurement ACLR`

Query of results: `:CALCulate:MARKer:FUNCtion:POWer:RESult? ACPower`

The *NO. OF ADJ CHAN* softkey enables input of the number ±n of adjacent channels which are taken into account for the adjacent channel powermeasurement.

Numbers between 0 and 3 can be entered.

The following measurements are performed depending on the number of channels.

0 Only the channel power is measured.

1 The channel power and the power of the upper and lower adjacent channel are measured.

2 The channel power, the power of the upper and lower adjacent channel and of the next upper and lower channel (alternate channel 1) are measured.

3 The channel power, the power of the upper and lower adjacent channel, the next higher and lower channel (alternate channel 1) and the next but one higher and lower channel (alternate channel 2) are measured.

IEC/IEEE bus command: `:SENS:POW:ACH:ACP 2`

The *ADJUST SETTINGS* softkey automatically optimizes the unit settings of the analyzer for the selected power measurement.
All the analyzer settings relevant to power measurement within a specific frequency range (channel bandwidth) are then optimized as a function of the channel configuration (channel bandwidth, channel spacing):

- Frequency span:
  The frequency span must cover at least all the channels that have to be taken into account.
  When the channel power is measured, the span is set as twice the channel bandwidth.
  The span setting depends for adjacent channel power measurement on the channel spacing and the channel bandwidth of the adjacent channel ADJ, ALT1 or ALT2 farthest away from the transmission channel.
- Resolution bandwidth RBW ≤ 1/40 of channel bandwidth
- Video bandwidth VBW ≥ 3 × RBW.
- Detector RMS detector

Trace math and trace averaging functions are disabled.
The reference level is not affected by *ADJUST SETTINGS*. It has to be adjusted separately by means of *ADJUST REF LVL*.

Adjustment is performed once; if necessary, the unit settings can be modified afterwards.

IEC/IEEE bus command: `:SENS:POW:ACH:PRES ACP|CPOW|OBW`

For manual setting of the test parameters different from the settings made with *ADJUST SETTINGS*, the following must be taken into account for the different parameters:

Frequency span

The frequency span must include at least all the channels needing to be measured.
This is the channel bandwidth when channel power is measured.
If the frequency span is large compared with the analyzed frequency section (or frequency sections), only a few pixels on the trace are available for the measurement.

Resolution bandwidth (RBW)

To ensure an acceptable measurement speed and also the necessary selectivity (for inhibiting spectral components outside the channel you want to measure, especially the adjacent channels), the resolution bandwidth must be selected so that it is neither too small nor too large. As a rule of thumb, the resolution bandwidth should to be set to values between 1% and 4% of the channel bandwidth. A larger resolution bandwidth can be set if the spectrum within and around the channel you want to measure has a flat characteristic.

Video bandwidth (VBW)

For a correct power measurement, the video signal must not be limited in terms of bandwidth. A restricted band of the logarithmic video signal would result in averaging and thus in a too low indication of the power (-2.51 dB for very low video bandwidths). The video bandwidth should therefore be at least three times the resolution bandwidth.

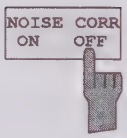
The *ADJUST SETTINGS* softkey sets the video bandwidth (VBW) as a function of the channel bandwidth as follows:

VBW ≥ 3 × RBW.

Detector

The *ADJUST SETTINGS* softkey selects the RMS detector.
The RMS detector is selected because it always indicates the power correctly irrespective of the characteristics of the signal you want to measure. In principle, even the sample detector would be possible. However, it would lead to unstable results due to the limited number of trace pixels for calculating the power in the channel. Averaging, which is frequently performed to stabilize measurement results, leads to the level indication being too low and should therefore be avoided. The reduction in the displayed power depends on the number of averages and the signal characteristics in the channel you want to measure.

The *SWEEP TIME* softkey activates the entry of the sweep time. With the RMS detector, a longer sweep time increases the stability of the measurement results.
The function of the softkey is identical to the softkey *SWEEP TIME MANUAL* in the menu *BW*.
IEC/IEEE-bus command: `:SWE:TIM <value>`



If the *NOISE CORR ON/OFF* softkey is activated, the results will be corrected by the instrument's inherent noise, which increases the dynamic range. When the function is switched on, a reference measurement of the instrument's inherent noise is carried out. The noise power measured is then subtracted from the power in the channel that is being examined. The inherent noise of the instrument depends on the selected center frequency, resolution bandwidth and level setting. Therefore, the correction function is disabled whenever one of these parameters is changed. A disable message is displayed on the screen. To enable the correction function in conjunction with the changed setting, press the softkey once more. A new reference measurement is carried out.

IEC/IEEE-bus command: `:SENS:POW:NCOR ON`

The *FAST ACLR* softkey toggles between measurement by the IBW method (FAST ACLR OFF) and the time domain method (FAST ACLR ON).

With *FAST ACLR ON*, the power measurement is performed in the different channels in the time domain. The analyzer adjusts its center frequency in succession to the different channel center frequencies and measures the power with the set measuring time (i.e. sweep time/number of measured channels). In doing so, the RBW filters suitable for the selected standard and frequency offset are used.

The RMS detector is used for correct power measurement. Consequently, no software correction factors are necessary.

Measure values are displayed in a table, the power in the useful channel being output in dBm and the power in the adjacent channels in dBm *(ACLR ABS)* or dB *(ACLR REL)*.

Selection of the sweep time (i.e. measuring time) depends on the desired reproducibility of results. Reproducibility of the results increases with sweep time since power measurement is then performed over a longer period of time.

As a rule of thumb, it is safe to assume for a reproducibility of 0.5 dB (99% of the measurements are within 0.5 dB of the true measured value) that approximately 500 uncorrelated measured values are necessary (this applies to white noise). Measured values are assumed to be uncorrelated when their time interval corresponds to the reciprocal of the measurement bandwidth (i.e. 1/BW).

For cdma2000 the measurement bandwidth is 10 kHz, i.e. measured values at an interval of 10 µs are assumed to be uncorrelated. Thus a measurement time (sweep time) of 50 ms per channel is required for 500 measured values. This is the default sweep time which the analyzer sets in coupled mode. Approximately 5000 measured values (i.e. the measurement time has to be extended to 500 ms) are required for a reproducibility of 0.1 dB (99% of all measurements are within 0.1 dB of the true measured values).

IEC/IEEE bus command: `:SENS:POW:HSP ON`

The soft key *DIAGRAM FULL SIZE* switches the diagram to full size.

IEC/IEEE bus command: -

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without the analyzer being overloaded or the dynamic response being limited by a too low signal-to-noise ratio. Since the measurement bandwidth is considerably lower for channel power measurements than the signal bandwidth, the signal path may be overloaded although the trace is still well below the reference level.

IEC/IEEE bus command: `:SENS:POW:ACH:PRES:RLEV`

The *ACLR LIMIT CHECK* softkey enables and disables the limit check for the ACLR measurement .

IEC/IEEE bus command:
```
:CALC:LIM:ACP ON
:CALC:LIM:ACP:ACH:RES?
:CALC:LIM:ACP:ALT:RES?
```

The default settings of limits are defined at the start of the adjacent channel power measurement as a function of the selected band class (refer to the BAND CLASS softkey), as in the tables on page 6.4. Similarly, the values in these tables are restored on a change of band class. After the band class has been selected, a table can be opened in the ACLR measurement, however, by means of the *EDIT ACLR LIMITS* softkey the limits for the ACLR measurement can be modified in the table..

ACP LIMITS

CHAN	RELATIVE LIMIT CHECK		ABSOLUTE LIMIT CHECK	
	VALUE	ON	VALUE	ON
ADJ	-45 dBc	x	0 dBm	
ALT1	-60 dBc	x	-27 dBm	
ALT2	-60 dBc	x	-27 dBm	x

The following rules apply to limits:

- A separate limit can be defined for each of the adjacent channels. The limit applies simultaneously to the lower and upper adjacent channels.
- A relative limit and/or an absolute limit can be defined. Checks of both limits can be enabled independently of each other.
- Compliance with the active limits is checked independently of whether the limits are absolute or relative and whether the measurement itself is performed in absolute levels or at relative signal intervals. If both checks are active and if the higher of the two limits has been exceeded, the measured value concerned is identified.

Note: *Measured values which exceed the limit are preceded by an asterisk and identified in red.*

IEC/IEEE bus command:

```
:CALC:LIM:ACP ON
:CALC:LIM:ACP:ACH 0dB,0dB
:CALC:LIM:ACP:ACH:STAT ON
:CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm
:CALC:LIM:ACP:ACH:ABS:STAT ON
:CALC:LIM:ACP:ALT1 0dB,0dB
:CALC:LIM:ACP:ALT1:STAT ON
:CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm
:CALC:LIM:ACP:ALT1:ABS:STAT ON
:CALC:LIM:ACP:ALT2 0dB,0dB
:CALC:LIM:ACP:ALT2:STAT ON
:CALC:LIM:ACP:ALT2:ABS -10dBm,-10dBm
:CALC:LIM:ACP:ALT2:ABS:STAT ON
```

The *CHANNEL BANDWIDTH* softkey enables entry of the channel bandwidth for the transmission channel.

The useful channel bandwidth is normally determined by the transmission procedure. The default setting of cdma2000 measures a channel bandwidth of 1.2288 MHz.

When measuring by the IBW method (*FAST ACLR OFF),* the channel bandwidth is represented on the screen by two vertical lines to the left and right of the center of the screen. This means that a visual check can be made to determine whether the whole power of the signal being measured is within the selected channel bandwidth.

With the time domain method (*FAST ACLR ON)*, the measurement is performed in zero span, the channel limits are not identified here. The analyzer provides all available channel filters for selection of the channel bandwidth entry. Any channel bandwidths deviating from this cannot be set. Should deviating channel bandwidths be necessary, perform the measurement by the IBW method.

IEC/IEEE bus command: `:SENS:POW:ACH:BWID 1.2288MHz`

The *ADJ CHAN BANDWIDTH* softkey opens a table for defining the channel bandwidths for the adjacent channels.

ACP CHANNEL BW	
CHAN	BANDWIDTH
ADJ	30 kHz
ALT1	30 kHz
ALT2	30 kHz

When using the IBW method (FAST ACLR OFF), enter the bandwidths of the different adjacent channels numerically. Since all adjacent channel frequently have the same bandwidth, entering the adjacent channel bandwidth (ADJ) also sets the other channels Alt1 and Alt2 to the bandwidth of the adjacent channel. This means that only one value has to be entered when adjacent channel bandwidths are identical. The procedure is similar for the Alt2 channels (alternate channels 2) with regard to entering bandwidth of the Alt1 channel (alternate channel 1).

Note: *The bandwidths can be set independently of each other by overwriting the table from top to bottom.*

With the time domain method (FAST ACLR ON), the adjacent channel bandwidths are selected from the list of available channel filters. Use the IBW method for deviating adjacent channel bandwidths.

IEC/IEEE bus command:
```
:SENS:POW:ACH:BWID:ACH 30kHz
:SENS:POW:ACH:BWID:ALT1 30kHz
:SENS:POW:ACH:BWID:ALT2 30kHz
```

The *ADJ CHAN SPACING* softkey opens a table for defining the channel spacings.

CHANNEL SPACING	
CHAN	SPACING
ADJ	750 kHz
ALT1	1.98 MHz
ALT2	4.00 MHz

Since adjacent channels frequently have identical spacings, entering the adjacent channel spacing (ADJ) sets channel ALT1 to twice and channel ALT2 to three times the channel spacing of the adjacent channel. This means that only one value has to be entered when channel spacings are identical. The procedure is similar with Alt2 channels when the bandwidth of the Alt1 channel is entered.

Note: *The channel spacings can be set independently of each other by overwriting the table from top to bottom.*

IEC/IEEE bus command: `:SENS:POW:ACH:SPAC:ACH 750kHz`
`:SENS:POW:ACH:SPAC:ALT1 1.98MHz`
`:SENS:POW:ACH:SPAC:ALT2 4MHz`

The *ACLR ABS/REL* softkey (channel power absolute/relative) toggles between absolute and relative measurement of the power in the channel.

ACLR ABS The absolute value of the power in the transmission channel and the adjacent channels is displayed in the unit of the Y-axis such as dBm or dBµV.

ACLR REL In the case of adjacent channel power measurement (*NO. OF ADJ CHAN* > 0), the level of the adjacent channels is displayed relative to the level of the transmission channel in dBc.

With linear scaling of the Y-axis, the relative power (CP/CP_{ref}) of the new channel to the reference channel is displayed. With dB scaling, the logarithmic ratio $10*lg$ (CP/CP_{ref}) is displayed. This means that the relative channel power measurement can also be used for universal adjacent channel power. Each channel is measured separately in this latter instance.

IEC/IEEE bus command: `:SENS:POW:ACH:MODE ABS`

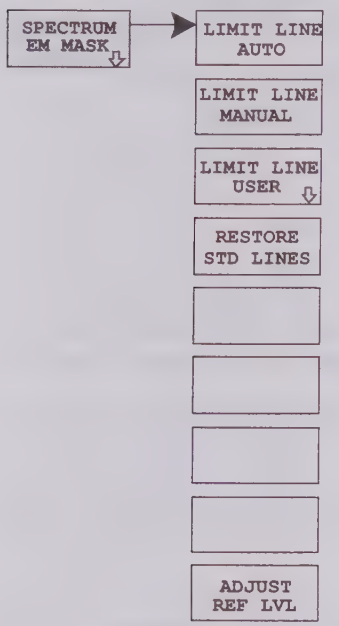
The *CHAN PWR / HZ* softkey toggles between measurement of the total power in the channel and measurement of the power in the channel referred to 1 Hz of bandwidth.

The conversion factor is $10 \cdot \lg \frac{1}{\text{Channel} \cdot \text{Bandwidth}}$.

IEC/IEEE bus command:
`:CALC:MARK:FUNC:POW:RES:PHZ ON|OFF`

Signal power check – SPECTRUM EM MASK

MEAS key or *MEAS* hot key



The *SPECTRUM EM MASK* (Spectrum Emission Mask) softkey measures the cdma2000 signal power in defined offsets from the carrier and compares the power values with the spurious emission mask, specified in the cdma2000 specification, in the near-carrier range from –4 MHz to 4 MHz.

The limits depend on the band class setting (*BAND CLASS* softkey).

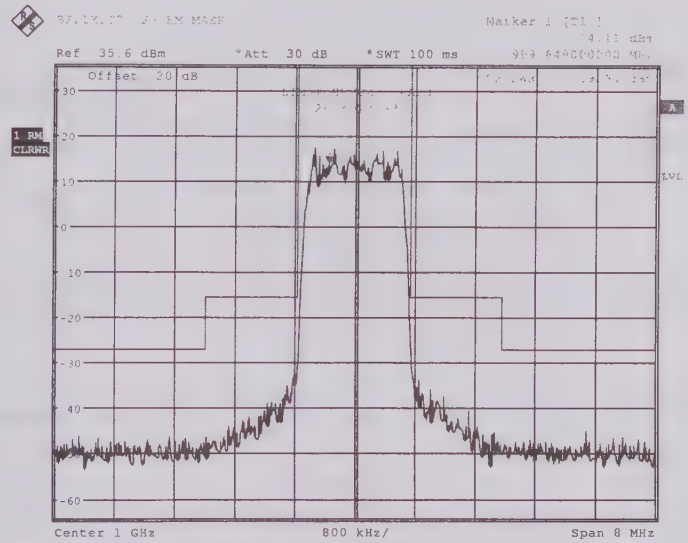


Fig. 6-3 Measurement of the spectrum emission mask.

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting: Level parameters Center Frequency + Frequency Offset All trigger settings	
ADJACENT CHAN POWER	ON
ACP STANDARD	cdma2000 MC1
NO OF ADJ. CHANNELS	0
FREQUENCY SPAN	8 MHz
SWEEP TIME	100 ms
DETECTOR	RMS

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode. Changing of the RBW and the VBW are limited because they are set by the definition of the limits.

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:
Level parameters
Sweep time
SPAN

IEC/IEEE bus comman :CONFigure:CDPower:MEASurement
ESPectrum

Query of result of limit line:
:CALCulate:LIMit:FAIL?

Query of results of worst fail:
:CALCulate:LIMit:ESPectrum:
CHECk:X?
:CALCulate:LIMit:ESPectrum:
CHECk:Y?

The *LIMIT LINE AUTO* softkey automatically selects the limit line after the power in the used channel has been determined. If the measurement is performed in *CONTINUOUS SWEEP* and if the channel power varies from sweep to sweep, it can result in continuous replotting of the limit line.
The softkey is enabled when the spectrum emission mask measurement is activated.

IEC/IEEE bus command: :CALC:LIM:ESP:MODE AUTO

The *LIMIT LINE MANUAL* softkey gives the user an opportunity to select the limit line manually. If this softkey is selected, the channel power measurement is not used for selecting the limit line but only for determining its relative components. The power for the different frequency offsets is compared with the limit line specified by the user.

The softkey opens a table with all the predefined limit lines on the unit:
Name of limit line
P >= 33 dBm
28 dBm <= P < 33 dBm
P < 28 dBm
The name of the limit line specifies the expected power range for which the limit line was defined.

IEC/IEEE bus command: :CALC:LIM:ESP:MODE MANual
:CALC:LIM:ESP:VALue 28
'Selects line 28 dBm <= P < 33 dBm

The definition of the limit line names is described at the *LIMIT LINE USER* softkey.

Table 6-5 Band classes 0, 2, 3, 5, 9, 10, 11 and 12 for carrier power P<28dBm

Offset frequency	Limit	Type/name C2KB0CR	RBW
-4.00 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-55 dBc	relative to carrier power	30 kHz
+4.00 MHz	-55 dBc	relative to carrier power	30 kHz

Table 6-6 Band classes 0, 2, 3, 5, 9, 10, 11 and 12 for carrier power 28 dBm <= 33 dBm

Offset frequency	Limit	Type/name C2KB0BA and C2KB0BR	RBW
-4.00 MHz	-27 dBm	Absolute	30 kHz
-1.98 MHz	-27 dBm	Absolute	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-27 dBm	Absolute	30 kHz
+4.00 MHz	-27 dBm	Absolute	30 kHz

Table 6-7 Band classes 0, 2, 3, 5, 9, 10, 11 and 12 for carrier power P >= 33 dBm

Offset frequency	Limit	Type/name C2KB0AR	RBW
-4.00 MHz	-60 dBc	relative to carrier power	30 kHz
-1.98 MHz	-60 dBc	relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-60 dBc	relative to carrier power	30 kHz
+4.00 MHz	-60 dBc	relative to carrier power	30 kHz

The limits for band class 7 are derived from band class 0. In addition a –46 dBm/6.25 kHz limit is defined between 3.25 MHz and 4 MHz. This limit is increased by 6.8 dB so that the 30 kHz resolution filter can be used for the measurement. The 30 kHz filter detects more power than the 6.25 kHz filter (10 log 30 kHz – 10 log 6.25kHz = 6.8 dB). Hence the limit is –46 dBm + 6.8 dB = -39.2 dBm.

Table 6-8 Band class 7 for carrier power P<28 dBm

Offset frequency	Limit	Type/name C2KB7CA and C2KB7R	RBW
-4.00 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-55 dBc	relative to carrier power	30 kHz
+3.25 MHz	-55 dBc	relative to carrier power	30 kHz
+3.25 MHz	-39.2 dBm	Absolute	30 kHz
+4.00 MHz	-39.2 dBm	Absolute	30 kHz

Table 6-9 Band class 7 for carrier power 28 dBm <= P < 33 dBm

Offset frequency	Limit	Type/name C2KB7BA and C2KB7BR	RBW
-4.00 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-27 dBm	Absolute	30 kHz
-1.98 MHz	-27 dBm	Absolute	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-27 dBm	Absolute	30 kHz
+3.25 MHz	-27 dBm	Absolute	30 kHz
+3.25 MHz	-39.2 dBm	Absolute	30 kHz
+4.00 MHz	-39.2 dBm	Absolute	30 kHz

Table 6-10 Band class 7 for carrier power P>= 33 dBm

Offset frequency	Limit	Type/name C2KB7AA and C2KB7AR	RBW
-4.00 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-39.2 dBm	Absolute	30 kHz
-3.25 MHz	-60 dBc	relative to carrier power	30 kHz
-1.98 MHz	-60 dBc	relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-60 dBc	relative to carrier power	30 kHz
+3.25 MHz	-60 dBc	relative to carrier power	30 kHz
+3.25 MHz	-39.2 dBm	Absolute	30 kHz
+4.00 MHz	-39.2 dBm	Absolute	30 kHz

The limits for band classes 1, 4 and 8 are defined by separate limits. RBW switching is benefitial in this instance to speed up the measurement. The 1 MHz channel filter is used for the 1 MHz segments. The frequency range is divided into three sub-segments. The user's sweep time is then spread over the segments as follows (k=filter velocity factor k) :

Segment1: -4.00 to -2.25 MHz RBW = 1 MHz k = 850 SWT1 = SWT * 1/10
Segment2: -2.25 to +2.25 MHz RBW = 30 kHz k = 2.5 SWT2 = SWT * 8/10
Segment3: +2.25 to 4.00 MHz RBW = 1 MHz k = 850 SWT3 = SWT * 1/10

For bigger Spans than 4 MHz the sweeptime is adjusted in that way that all three segments are swept with the same filter velocity factor k.

For entering the limit "Stricter of" a check determines whether P – 45 dBc > -9 dBm. If this is the case, the measured value is compared with P – 45 dBc, in all other cases with –9 dBm.

Table 6-11 Band classes 1, 4 and 8 for carrier power P<28 dBm

Offset frequency	Limit	Type/name C2KB1CA and C2KB1CR	RBW
-4.00 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-50 dBc	relative to carrier power	30 kHz
-1.98 MHz	-50 dBc	relative to carrier power	30 kHz
-1.98 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
-1.25 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
-1.25 MHz	-45 dBc	relative to carrier power	30 kHz
-885 kHz	-45 dBc	relative to carrier power	30 kHz
+885 kHz	-45 dBc	relative to carrier power	30 kHz
+1.25 MHz	-45 dBc	relative to carrier power	30 kHz
+1.25 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	-50 dBc	relative to carrier power	30 kHz
+2.25 MHz	-50 dBc	relative to carrier power	30 kHz
+2.25 MHz	-13 dBm	absolute	1 MHz
+4.00 MHz	-13 dBm	absolute	1 MHz

Table 6-12 Band classes 1, 4 and 8 for carrier power 28 dBm <= P < 33 dBm

Offset frequency	Limit	Type/name C2KB1BA and C2KB1BR	RBW
-4.00 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-22 dBm	absolute	30 kHz
-1.98 MHz	-22 dBm	absolute	30 kHz
-1.98 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
-1.25 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
-1.25 MHz	-45 dBc	relative to carrier power	30 kHz
-885 kHz	-45 dBc	relative to carrier power	30 kHz
+885 kHz	-45 dBc	relative to carrier power	30 kHz
+1.25 MHz	-45 dBc	relative to carrier power	30 kHz
+1.25 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	-22 dBm	absolute	30 kHz
+2.25 MHz	-22 dBm	absolute	30 kHz
+2.25 MHz	-13 dBm	absolute	1 MHz
+4.00 MHz	-13 dBm	absolute	1 MHz

Table 6-13 Band classes 1, 4 and 8 for carrier power P >= 33 dBm

Offset frequency	Limit	Type/name C2KB1AA and C2KB1AR	RBW
-4.00 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
-1.25 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
-1.25 MHz	-45 dBc	relative to carrier power	30 kHz
-885 kHz	-45 dBc	relative to carrier power	30 kHz
+885 kHz	-45 dBc	relative to carrier power	30 kHz
+1.25 MHz	-45 dBc	relative to carrier power	30 kHz
+1.25 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	-55 dBc	relative to carrier power	30 kHz
+2.25 MHz	-55 dBc	relative to carrier power	30 kHz
+2.25 MHz	-13 dBm	absolute	1 MHz
+4.00 MHz	-13 dBm	absolute	1 MHz

The limits for band class 6 are derived from the limits of band classes 1, 4 and 8. The difference is that there is no dependence on carrier power and there is a gradient between 1.45 and 2.25 MHz from the carrier center(?).

Table 6-14 Band class 6 for all carrier power values

Offset frequency	Limit	Type/name C2KB6_A and C2KB6_R	RBW
-4.00 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-26.6 dBm	absolute	30 kHz
-1.45 MHz	-13 dBm	absolute	30 kHz
-1.25 MHz	-13 dBm	absolute	30 kHz
-1.25 MHz	-45 dBc	relative to carrier power	30 kHz
-885 kHz	-45 dBc	relative to carrier power	30 kHz
+885 kHz	-45 dBc	relative to carrier power	30 kHz
-1.25 MHz	-45 dBc	relative to carrier power	30 kHz
-1.25 MHz	-13 dBm	absolute	30 kHz
-1.45 MHz	-13 dBm	absolute	30 kHz
-2.25 MHz	-26.6 dBm	absolute	30 kHz
-2.25 MHz	-13 dBm	absolute	1 MHz
-4.00 MHz	-13 dBm	absolute	1 MHz

The *LIMIT LINE USER* softkey enables the creation of user-defined limit lines. The softkey opens the menus of the limit-line editor, which may be familiar from the basic unit. The limit lines created by the user are included in the table for *LIMIT LINE MANUAL*.
The following limit line settings are recomended for base station tests: Trace 1, Domain Frequency, X-Scaling relative, Y-Scaling absolute, Spacing linear, Unit dBm.
Unlike the default limit lines on the unit that conform to the standard specifications when the analyzer is supplied, the user-specified limit line can be specified for the whole frequency range (±4.0 MHz from the carrier) only either relatively (referred to the reference level) or absolutely.

The supplied limit lines of AUTO and MANUAL modes can also be selected. The names are specified next to the type in the tables above and are defined as follows:

1) Standard in three characters
2) Link direction B for base station
3) Band class, with more than one band class the lowest digit is used
4) Power classes A, B, C or _ where A is the highest power class and _ is used when there is no dependency on power class.
5) Type differentiation: A for absolute and R for relative

Example with regard to cdma2000 band classes 0, 2, 3, 5, 9, 10, 11 and 12 for P <28 dBm:

```
C2K      : cdma2000
   B     : base station
    0    : lowest of band classes 0, 2, 3, 5 , 9 - 12
     C   : lowest of the three power classes
      R  : relative line
=========
C2KB0CR
```

The limit line names are shown in the table above next to the type.

IEC/IEEE bus command: refer to **Fehler! Verweisquelle konnte nicht gefunden werden.**

The *RESTORE STD LINES* softkey restores the limit lines defined in the standard to the state they were in when the firmware was installed. In this way unintended overwriting of the standard lines can be undone.

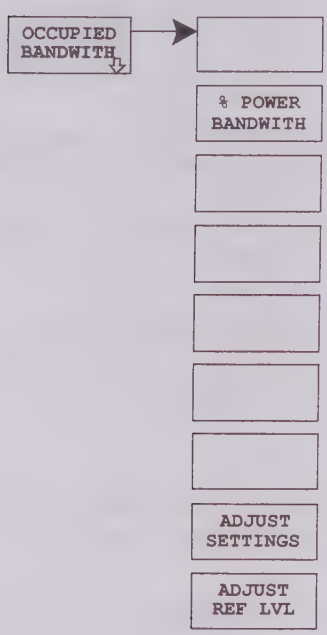
IEC/IEEE bus command: `:CALC:LIM:ESP:RESTore`

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured total signal power.
The softkey becomes active when the first sweep ends with measurement of the occupied bandwidth and the total power of the signal is known.
Adaptation of the reference level ensures that the signal path of the analyzer is not overloaded, and the dynamic response is not restricted by a reference level that is too low.

IEC/IEEE bus command: `:SENS:POW:ACH:PRES:RLEV`

Measuring bandwidth occupied by the signal - OCCUPIED BANDWITH

MEAS key or *MEAS* hot key



The *OCCUPIED BANDWIDTH* softkey enables measurement of the bandwidth occupied by the signal.
This measurement determines the bandwidth in which - in the initial state - 99% of the signal power will be found. The percentage signal power required to be included in the bandwidth measurement can be modified. The bandwidth and the frequency markers for the measurement are displayed in the Marker Info field in the top right corner of the display.

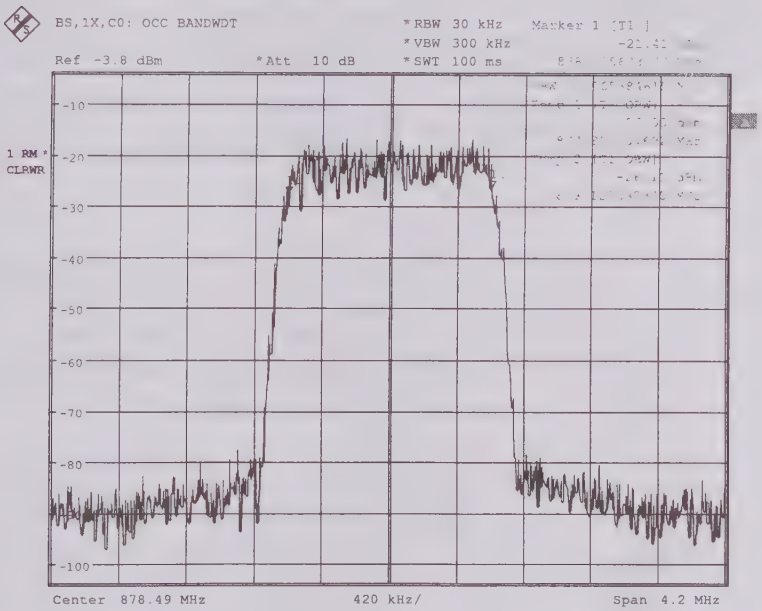


Fig. 6-4 Measuring occupied bandwidth

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting: Level parameters Center Frequency + Frequency Offset All trigger settings	
OCCUPIED BANDWIDTH	ON
FREQUENCY SPAN	4.2 MHz
SWEEP TIME	100 ms
RBW	30 kHz
VBW	300 kHz
DETECTOR	RMS

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:
Level parameters
RBW, VBW
Sweep time
SPAN

IEC/IEEE bus command: `:CONFigure:CDPower:MEASurement OBANdwidth`
Query of results: `:CALCulate:MARKer:FUNCtion:POWer:RESult? OBANdwidth`

The % POWER BANDWIDTH softkey opens a field for entering the percentage power referred to the total power in the displayed frequency range, by means of which the occupied bandwidth is defined (percentage of total power).
The permissible range is 10% to 99.9%.

IEC/IEEE bus command: `:SENS:POW:BWID 99PCT`

The *ADJUST SETTINGS* softkey matches the analyzer unit settings to the specified channel bandwidth for measurement of the occupied bandwidth.
All analyzer settings relevant to power measurement within a certain frequency range (channel bandwidth) such as:

- Frequency span 3 x channel width
- Resolution bandwidth RBW ≤ 1/40 of channel bandwidth.
- Video bandwidth VBW ≥ 3 × RBW.
- Detector RMS

are optimized.

The reference level is not affected by *ADJUST SETTINGS*. It must be set for optimum dynamics so that the maximum signal is in the proximity of the reference level.

Adjustment is performed only once but, if necessary, the unit settings may be changed afterwards.

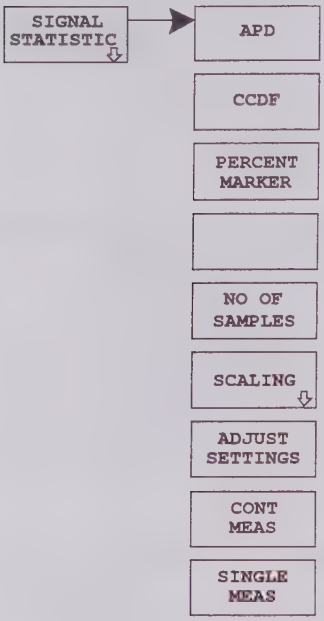
IEC/IEEE bus command: `:SENS:POW:ACH:PRES OBW`

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured total signal power.
The softkey becomes active when the first sweep ends with measurement of the occupied bandwidth and the total power of the signal is known.
Adaptation of the reference level ensures that the signal path of the analyzer is not overloaded, and the dynamic response is not restricted by a reference level that is too low.
Since the measurement bandwidth is considerably lower for channel power measurements than the signal bandwidth, the signal path may be overloaded although the trace is still well below the reference level. When the measured channel power is identical to the reference level, the signal path is not overloaded.

IEC/IEEE bus command: `:SENS:POW:ACH:PRES:RLEV`

Signal statistic

MEAS key or *MEAS* hot key



The *SIGNAL STATISTIC* softkey launches measurement of the distribution function of signal amplitudes (complementary cumulative distribution function). The measurement can be switched, using the menu softkey, to amplitude power distribution (APD).

For this measurement, a signal section of settable length is recorded continuously in a zero span, and the distribution of the signal amplitudes is evaluated. The recorded length and the display range of the CCDF can be set using the softkeys of the menu. The amplitude distribution is plotted logarithmically as a percentage of the amount by which a certain level is exceeded, starting with the average value of the signal amplitudes.
In addition, the crest factor, i.e. the difference between the maximum value and the mean power, is displayed in dB.

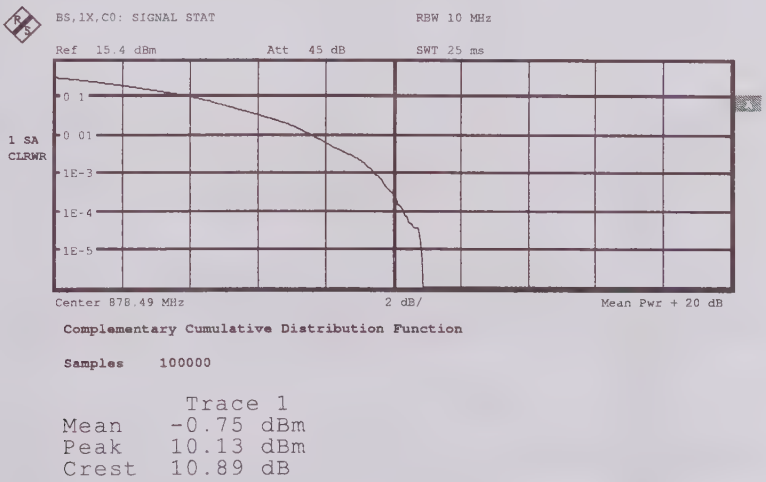


Fig. 6-5 CCDF of cdma2000 signal.

The softkey enables SPECTRUM mode with predefined settings:

The following user-specific settings are not modified so that the adaptation to the device under test is preserved:

Reference Level + Rev Level Offset
Center Frequency + Frequency Offset
Input Attenuation + Mixer Level
All trigger settings

CCDF	ON
RBW	10 MHz
DETECTOR	SAMPLE

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:

Level parameters
RBW
NO OF SAMPLES

Departing from this setting, the analyzer can be operated in all the functions it features in SPECTRUM mode, i.e. all measurement parameters can be adapted to a specific measurement.

IEC/IEEE bus command: `:CONFigure:CDPower:MEASurement CCDF`
or
`:CALCulate:STATistics:CCDF ON`

Query of results:

`:CALCulate:MARKer:X?`
`:CALCulate:STATistics:RESults? MEAN | PEAK |CFActor | ALL`

MEAN mean (r.m.s) measured power in dBm in the period of observation

PEAK measured peak power in dBm in the period of observation

CFACtor determined CREST factor (i.e. ratio of peak power to mean power) in dB

ALL results of all three named measurements, separated by a comma: <mean pow>, <peak pow>, <crest factor>

The *APD ON/OFF* softkey enables the amplitude probability distribution function .

IEC/IEEE bus command: `CALC:STAT:APD ON`

The *CCDF ON/OFF* softkey enables the complementary distribution function (complementary cumulative distribution function).

IEC/IEEE bus command: `:CALC:STAT:CCDF ON`

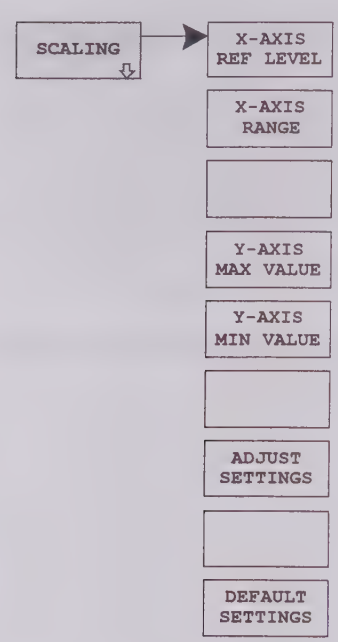
When the CCDF function is enabled, the *PERCENT MARKER* softkey supports positioning of marker 1 by entering a sought probability. In this way the power which exceeds a specified probability can be determined in a simple manner.
If marker 1 is disabled, it is enabled automatically.

IEC/IEEE bus command: `:CALC:MARK:Y:PERC 0...100%`

The *NO OF SAMPLES* softkey sets the number of power measured values to be taken into account for the calculation of the distribution function.

Note: *The overall measurement time is influenced by the selected number of samples as well as by the resolution bandwidth selected for the measurement, since the resolution bandwidth directly affects the sampling rate.*

IEC/IEEE bus command: `:CALC:STAT:NSAM <value>`



The *SCALING* softkey opens a menu on which the scaling parameters for the X-axis and the Y-axis can be modified.

The *X-AXIS REF LEVEL* softkey changes the level settings of the unit and sets the maximum measurable power.
The function is identical to that of the *REF LEVEL* softkey on the *AMPT* menu.
This value is mapped to the right diagram border for the *APD* function. For the *CCDF* function, this value is not directly represented in the diagram because the X-axis is scaled relative to the measured *MEAN POWER*.

IEC/IEEE bus command: `:CALC:STAT:SCAL:X:RLEV <value>`

The *X-AXIS RANGE* softkey changes the level range that is to be covered by the distribution sampling function.
The function is identical to that of the *RANGE LOG MANUAL* softkey on the *AMPT* menu.

IEC/IEEE bus command: `:CALC:STAT:SCAL:X:RANG <value>`

The *Y-AXIS MAX VALUE* softkey sets the upper limit of the displayed probability range.
The values on the Y-axis are normalized, i.e. the maximum value is 1.0. Since the Y-axis scaling is logarithmic, the spacing between the maximum and minimum values must be at least one decade.

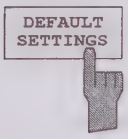
IEC/IEEE bus command: `:CALC:STAT:SCAL:Y:UPP <value>`

The *Y-AXIS MIN VALUE* softkey sets the lower limit of the displayed probability range.
Since the Y-axis scaling is logarithmic, the spacing between the maximum and minimum values must be at least one decade. Permissible range 0 < value < 1.

IEC/IEEE bus command: `:CALC:STAT:SCAL:Y:LOW <value>`

The *ADJUST SETTINGS* softkey optimizes the analyzer level settings according to the measured peak power in order to gain maximum sensitivity of the unit.
The level range is set for the APD measurement according to the measured distance between the power peak value and the minimum value and for the CCDF measurement between the power peak value and the mean value in order to achieve maximum power resolution.
In addition, the probability scale is adapted to the selected number of samples.

IEC/IEEE bus command: `:CALC:STAT:SCAL:AUTO ONCE`



The *DEFAULT SETTINGS* softkey resets the scaling on the X-axis and the Y-axisto the default (PRESET) settings.

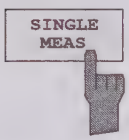
X-axis reference level: -20 dBm
X-axis range for APD: 100 dB
X-axis range for CCDF: 20 dB

Y-axis for upper limit: 1.0
Y-axis for lower limit: 1E-6

IEC/IEEE bus command: `:CALC:STAT:PRES`

The *CONT MEAS* softkey starts the collection of new sequences of sample data and the calculation of the APD or CCDF trace, depending on the selected measurement. The next measurement is started automatically as soon as the indicated number of samples has been reached ("CONTinuous MEASurement").

IEC/IEEE bus command:
```
:INIT:CONT ON;
:INIT:IMM
```



The *SINGLE MEAS* softkey starts the collection of one new sequence of sample data and the calculation of the APD or CCDF trace, depending on the selected measurement. The measurement terminates when the indicated number of samples is reached.

IEC/IEEE bus command:
```
:INIT:CONT OFF;
:INIT:IMM
```

Code domain measurements on cdma2000/1xEV-DV signals

The Application Firmware R&S FS-K82 features a code domain analyzer. It can be used used to perform the measurements required in the cdma2000 standards with regard to the power of the different codes and code channels (concentrated codes). In addition, the modulation quality (EVM and RHO factor), frequency errors and trigger-to-frame time, and peak-code domain errors are determined. Constellation evaluations and bitstream evaluations are also available. Furthermore the timing and phase offsets of the channels to the pilot can also be calculated (refer to the *TIME/PHASE* softkey). The observation period can be set as multiples of the power control group (PCG) using the *CAPTURE LENGTH* softkey.

Basically, the firmware differentiates between the following result classes for the evaluations:

- Results which take the overall signal into account over the whole observation period (all PCGs)
- Results which take the overall signal into account over a power control group (PCG)
- Results which take one channel into account over the whole observation period (all PCGs)
- Results which take one channel into account over a power control group (PCG)

The evaluations of the code domain analyzer are performed on a split screen. The screen is divided into two halves for this purpose.
The upperhalf of the screen (screen A) displays evaluations which vary by means of the codes. The lower screen (screen B) displays all other evaluations.

Table 6-15 Evaluations on screen A

Evaluation on screen A	Total signal	One channel	All PCGs	One PCG
Code domain power	✓			✓
Code domain error power	✓			✓
Channel table	✓			✓

Table 6-16 Evaluations on screen B

Evaluation on screen B	Total signal	One channel	All PCGs	One PCG
Result Summary	✓	✓	✓	✓
Power versus power control group		✓	✓	
Power versus symbol		✓		✓
Composite EVM (modulation accuracy)	✓		✓	
Composite constellation	✓			✓
Peak code domain error	✓		✓	
Symbol constellation		✓		✓
Symbol EVM		✓		✓
Bitstream		✓		✓

Depending on the symbol rate of a code channel, it has a different spreading factor and a different number of symbols per power control group. The relationship can be seen in the table below.

Table 6-17 Relationship between symbol rate, spreading factor and number of symbols

Transmission speed [ksps]	Spreading factor	Symbols per PCG (no transmit diversity)	Symbols per PCG (transmit diversity)
9.6	128	12	6
19.2	64	24	12
38.4	32	48	24
76.8	16	96	48
153.6	8	192	96
307.2	4	384	192

With evaluations on the lower screen which have uses symbols on the x-axis, the maximum number of symbols varies according to the symbol rate of the selected code channel. With transmit diversity signals (softkey *ANT DIV*) the symbols of the signal are distrubuted on two antennas. Therefore the symbol number is reduced to the half.

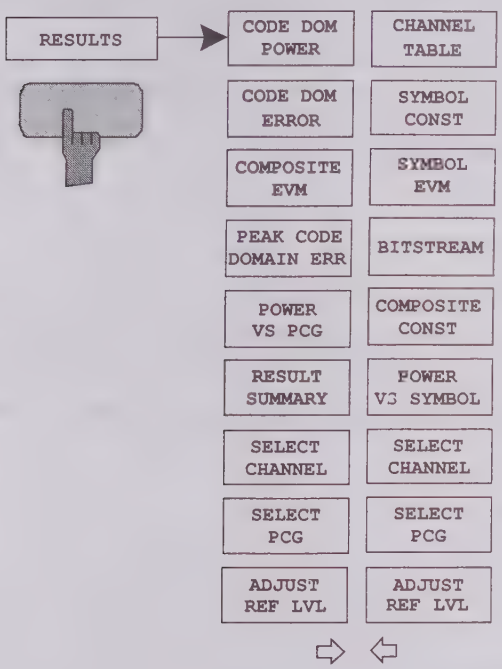
With the help of the *SELECT CHANNEL* and *SELECT PCG* softkeys, the user can select the code channel and the power control group (PCG) for which he wants to have a result displayed. Let us assume that he has selected code channel 1.64 (Walsh code number 1 for spreading factor 64) and PCG 2. On screen A, the code domain power relative evaluation is active and on screen B the symbol EVM evaluation is active. Screen A thus displays the code domain power evaluation of PCG 2. In this instance code channel 1.64 is shown in red. In the lower half of the screen you can see the symbol EVM evaluation of code channel 1.64 in PCG 2 with 24 corresponding values.

The code domain analyzer can be operated in two modes. In CODE CHAN AUTOSEARCH mode it performs an automatic search for active channels in the whole code domain. During the search, the PILOT CHANNEL (PICH) at 0.64, the SYNCHRONISATION CHANNEL (SYNC) at 32.64, the TRANSMIT DIVERSITY PILOT CHANNEL (TDPICH) at 16.128 and the first PAGING CHANNEL (PCH) at 1.64 are detected automatically if they are active. In addition, active data channels, generally referred to as CHAN, are detected with their radio configuration 1+2 or 3 to 5.
PACKET DATA CHANNELS (PDCH) from 1xEV-DV are always sent from the base station with spreading factor 32. The standard defines for these channel radio configuration 10. These packet channels can be either QPSK (like the normal data channels CHAN), 8-PSK or 16-QAM modulated. The modulation types is automatically detected by the application firmware and in case of 8-PSK/16-QAM the detected channel is recognised as PDCH with radio configuration 10. The difference between CHAN and PDCH with QPSK modulation is not unambiguous, therefore the softkey *FORCE 1xEV-DV* exists which can force the 1xEV-DV recognition (PDCH/radio configuration 10).
The structure of the PACKET DATA CONTROL CHANNEL (PDCCH) is similar to a normal data channel (CHAN) and can not be distinguished in the automatic search mode. But it is possible to add the PDCCH in the CODE CHAN PREDEFINED mode.
In the another mode, CODE CHAN PREDEFINED, the user is given the opportunity of determining the active code channels in the signal by means of selectable and editable tables. The automatic channel search is then replaced by this user input.

The code domain analyzer requires the presence of the PILOT CHANNEL (PICH) or, in the case of OTD (orthogonal transmit diversity), the TRANSMIT DIVERSITY PILOT CHANNEL (TDPICH).

Presentation of evaluations - RESULTS

The *RESULTS* hot key or the *MEAS* hot key and then the *CODE DOM ANALYZER*



The *RESULTS* hot key opens the submenu for choosing the evaluation. The main menu features the most important evaluations for rapid access; more detailed evaluations are available on the Page menu.

You can choose from the following evaluations:

CODE DOM POWER
: Code domain power evaluation, depending on the CODE PWR ABS/REL softkey in relative or absolute scaling

CODE DOM ERROR
: Code domain error power evaluation

COMPOSITE EVM
: Square difference between the test signal and the ideal reference signal

PEAK CODE DOMAIN ERR
: Projection of the error between the test signal and the ideal reference signal to the base spreading factor and subsequent summation using the symbols of each PCG of the difference signal

POWER VS PCG
: Power of the selected channel versus all PCGs

RESULT SUMMARY
: Results in tabular form

CHANNEL TABLE
: Channel occupancy table

SYMBOL CONST
: Symbol constellation evaluation

SYMBOL EVM
: Error vector magnitude evaluation

BITSTREAM
: Display of decided bits

COMPOSITE CONST
: Composite constellation evaluation

POWER VS SYMBOL
: Power of the selected channel and of the selected PCG versus all symbols

By entering a channel number (*SELECT CHANNEL* softkey) the user can select a channel for the evaluations *POWER VS PCG, SYMBOL CONST, SYMBOL EVM, BITSTREAM* and POWER VS SYMBOL.

The user can use the *SELECT PCG* softkey to select a power control group for the evaluations CODE DOM POWER, CODE ERROR, CHANNEL TABLE, SYMB CONST, SYMBOL EVM, BITSTREAM, COMPOSITE CONST and POWER VS SYMBOL.

The user use *ADJUST REF LVL* to achieve optimum matching of the reference level to the signal level.

The following user-specific settings are not modified on the first access following presetting:

Level parameters

Center Frequency + Frequency Offset

Input Attenuation + Mixer Level

The following user-specitic settings are transferred as follows:

External trigger sources are retained, while all other trigger sources result in Free Run mode. Additional trigger settings are retained.

To restore adjusted level parameters, they are saved on exiting the code domain analyzer and reset on re-entering the code domain analyzer.

The most important measurement settings on which the displays are based are summarized at the top of the diagram:

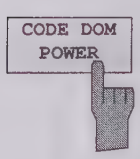
Fig. 6-6 Function fields of diagrams

The meanings are as follows:

1st column: Mobile radio system (base station cdma2000 1X) `BS,1X`
Band class (classes 0 to 12) abbreviated such as `C1` for 1900 MHz band
Name of the selected evaluation: such as `CODE POWER`
(empty)
Unit of the y-axis such as `dB TOT` for relative to the total power

2nd column: (empty)
(empty)
Center frequency of the signal. such as `CF 1.93125 GHz`

3rd column: Symbol rate of the selected channel : such as `SR 19.2 ksps`
Walsh code and spreading factor of the selected channel: such as `Chan 1.64`
PCG number of the selected channel `PCG 3`



The CODE DOM POWER softkey selects the evaluation of the code domain power (CDP) with relative scaling.

With the code domain power evaluation, the total signal is taken into account over precisely one power control group. The power values of the different codes are determined and plotted in a diagram. In this diagram, the x-axis is the code number and the y-axis is a logarithmic level axis. The number of codes on the x-axis, which corresponds to the base spreading factor, can be set by means of the *BASE SF 64/128* softkey. The power control group to be evaluated can be set by means of the *SELECT PCG* softkey.

The power of the channels is referred to the power of the pilot channel PICH (code number 0) at the default setting. This power reference has been selected since the total power can vary, between the PCG, due to the possibility of a power level change in the different code channels. Unlike this variable total power, the power of the PICH is identical over all PCGs and hence it can be used as a constant reference for the display. If the second antenna is measured (refer to softkeys *ANT DIV* and *ANT NO.*), the pilot channel of the second antenna TDPICH is used as the reference. The power reference can be switched to the total power of the signal with the help of the *POWER REF* softkey.

Apart from these relative displays, there is also the option of specifying the absolute power. It can be enabled by means of the CODE PWR ABS/REL softkey. The unit of y-axis is consequently dBm for absolute evaluation and dB PICH for relative evaluation with regard to the pilot, dB TDPICH for relative evaluation with regard to the pilot when measuring the second antenna and dB TOT for relative evaluation with regard to the total power.

The power values of the active and unassigned codes are shown in different colours. In addition, codes with alias power can occur. In this instance a code contains power components originating either from a spreading factor higher than the base spreading factor or the own and/or a different antenna as a result of transmit diversity.
The following colours are defined:

- Yellow active channel
- Cyan unoccupied
- Light blue alias power of higher spreading factor
- Magenta alias power as a result of transmit diversity

Note: *If there is alias power in the code domain power evaluation, the highest base spreading factor should be set by means of the BASE SF softkey.*

A channel in *CODE CHAN AUTOSEARCH* mode (automatic channel search mode) is referred to as active when the minimum power entered by the user (refer to the INACT CHAN THRESHOLD softkey) is exceeded and there is an adequate signal-to-noise ratio. In *CODE CHAN PREDEFINED* mode, each code channel contained in the user-defined channel table is identified as active.

The code domain power evaluation supports two sort orders: the Hadamard and BitReverse orders. In Hadamard order, the codes are sorted and displayed in ascending order: 0.64, 1.64, 2.64, etc, 63.64. For each code, the power is displayed in this code. If there is a code channel in the signal that covers several codes, the individual power of the codes is displayed. If you wish to read the total power of this concentrated code channel, use BitReverse order.

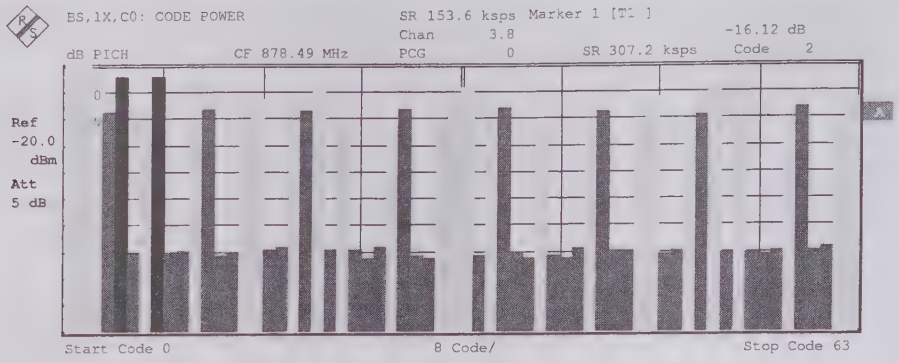


Fig. 6-7 CDP diagram in Hadamard order

With BitReverse order, the sort order of the channels is changed in such that the code numbers at bit level are interpreted from back to front (reversed). The following code order thus results for a base spreading factor of 64: 0.64, 32.64, 16.64, 48.64, 8.64, 40.64, etc., 15.64, 47.64, 31.64, 63.64 (refer to Chapter 9). The codes of a concentrated code channel are now adjacent and the total power of the code channel is displayed.

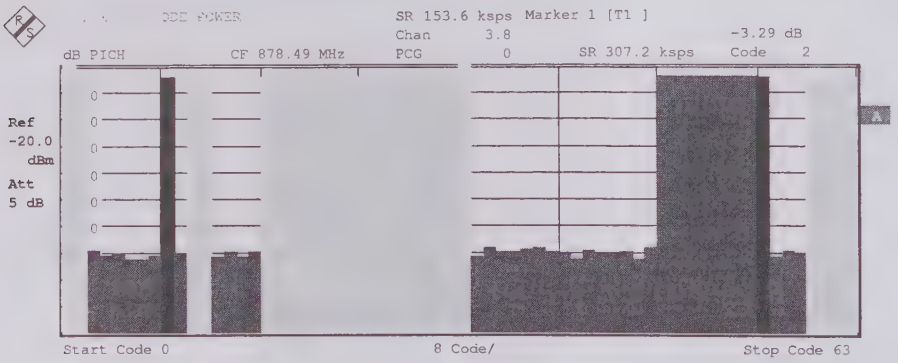


Fig. 6-8 CDP diagram in BitReverse order for the same signal

By entering a channel number (refer to the *SELECT CHANNEL* softkey), you can select a channel for more detailed displays. The codes of this channel are shown in red.
The selection of more detailed evaluations (such as SYMBOL CONSTELLATION) for unassigned codes is possible but not meaningful, since the results are not valid.

IEC/IEEE bus command: `:CALCulate<1>:FEED "XPOW:CDP:RAT"` (relative)
`:CALCulate<1>:FEED "XPOW:CDP"` (absolute)

The CODE DOM ERROR softkey selects the evaluation of the code domain error power (CDEP).

The code-domain error power measurement reads out the difference in power between measured and ideally generated reference signals for each code in dB. Since it is an error power, active and inactive channels can be assessed jointly at a glance with this evaluation.

With the code-domain error power evaluation, the total signal is taken into account over exactly one power control group and the error power in the different codes are determined and plotted in a diagram. In this diagram, the x-axis is the code number and the y-axis is a logarithmic level axis, the unit being dB. The number of codes on the x-axis, which corresponds to the base spreading factor, can be set by means of the *BASE SF 64/128* softkey. The power control group you want to evaluate can be set by means of the *SELECT PCG* softkey.

The power values of the active and unassigned codes are shown in different colours. In addition, codes with alias power can occur. In this instance a code contains power components originating either from a spreading factor higher than the base spreading factor of the own and/or a different antenna as a result of transmit diversity.
The following colours are defined:

- Yellow active channel
- Cyan unoccupied
- Light blue alias power of higher spreading factor
- Magenta alias power as a result of transmit diversity

Note: *If there is alias power in the code domain power evaluation, the highest base spreading factor should be set by means of the BASE SF softkey.*

A channel in *CODE CHAN AUTOSEARCH* mode (automatic channel search mode) is referred to as active when the minimum power entered by the user (refer to the INACT CHAN THRESHOLD softkey) is exceeded and there is an adequate signal-to-noise ratio. In *CODE CHAN PREDEFINED* mode, each code channel contained in the user-defined channel table is identified as active.

The code-domain error power evaluation supports two sort orders: the Hadamard and BitReverse orders. In Hadamard order, the codes are sorted and displayed in ascending order: 0.64, 1.64, 2.64, etc., 63.64. For each code, the power is displayed in this code.

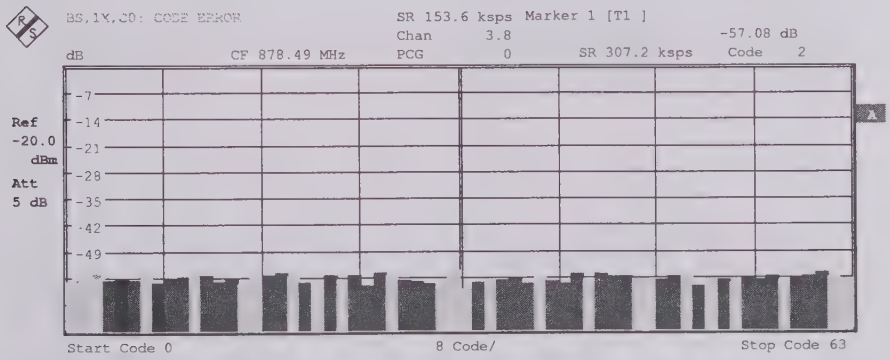


Fig. 6-9 CDEP diagram in Hadamard order

With BitReverse order, the sort order of the channels is changed in such that

the code numbers at bit level are interpreted from back to front (reversed). The following code order thus results for a base spreading factor of 64: 0.64, 32.64, 16.64, 48.64, 8.64, 40.64, etc., 15.64, 47.64, 31.64, 63.64 (refer to Chapter 9). With the code-domain error power evaluation, unlike the code domain power evaluation, no power values of the concentrated code channel are displayed, since the power values in the code-domain error power evaluation are error power values.

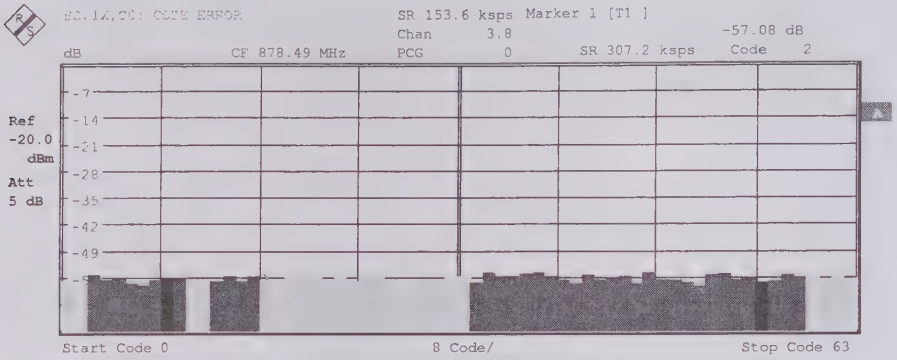


Fig. 6-10 CDEP diagram in BitReverse order for the same signal

By entering a channel number (refer to the *SELECT CHANNEL* softkey), you can select a channel for more detailed displays. The codes of this channel are shown in red.
The selection of more detailed evaluations (such as SYMBOL CONSTELLATION) for unassigned codes is possible but not meaningful, since the results are not valid.
IEC/IEEE bus command: `:CALCulate<1>:FEED "XPOW:CDEP"`

The *COMPOSITE EVM* softkey selects the evaluation of the error vector magnitude (EVM) over the total signal (modulation accuracy).

In the composite EVM measurement, the square root is determined from the error square between the real and imaginary parts of the test signal and an ideally generated reference signal (EVM referred to the total signal).

The measurement result consists of a composite EVM measured value for each power control group (PCG). You can set the number of PCGs by means of the *CAPTURE LENGTH* softkey. Subsequently, the COMPOSITE EVM evaluation takes the whole signal into account over the entire period of observation.

Only the channels detected as being active are used to generate the ideal reference signal. In the case of a channel which is not detected as being active on account of, say low power, the difference between the test signal and the reference signal and the composite EVM is therefore very large (refer to the figure).

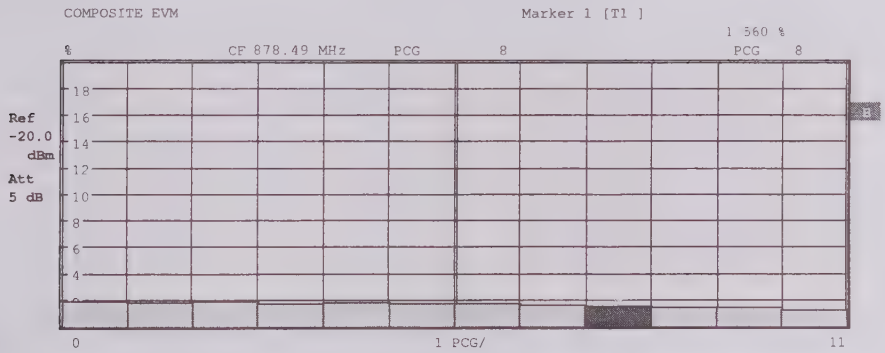


Fig. 6-11 Composite EVM display for the case of all the channels contained in the signal being detected as active

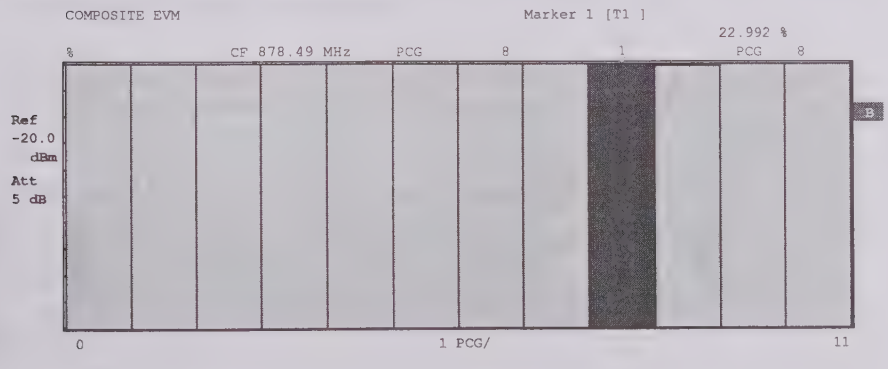
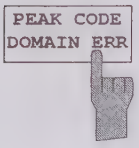


Fig. 6-12 Composite EVM display for the case of one code channel was not detected as being active.

Similar to selecting a code channel in the CDP or CDEP diagram, there is the option in the composite EVM diagram of selecting a PCG. The selection is performed by entering the PCG number (refer to the *SELECT PCG* softkey). The selected PCG is shown as a red bar.

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:MACCuracy"`



The *PEAK CODE DOMAIN ERR* softkey selects the evaluation of the peak code domain error.

With the peak code domain error measurement, the error is between the test signal and the ideally generated reference signal is projected to the base spreading factor. The unit on the y-axis is dB. The base spreading factor is selected by means of the *BASE SF 64/128* softkey.

The measurement result consists of the numeric value per PCG for the peak code domain error. You can set the number of PCGs by means of the *CAPTURE LENGTH* softkey. Subsequently, the peak code domain error evaluation takes the whole signal into account over the entire period of observation.

Only the channels detected as being active are used to generate the ideal reference signal for the peak code domain error. If an assigned code is not detected as being active on account of low power, the difference between the test signal and the reference signal is very large. The R&S FS-K82 therefore shows a peak code domain error that is too high (refer to figure).

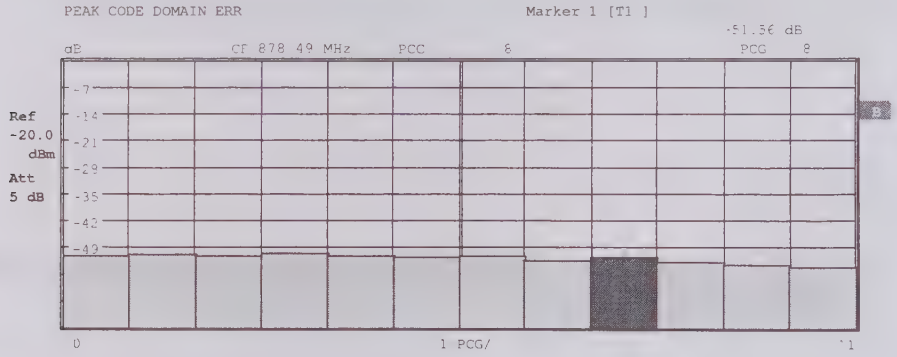


Fig. 6-13 Peak code domain error for the case of all the channels contained in the signal being detected as active

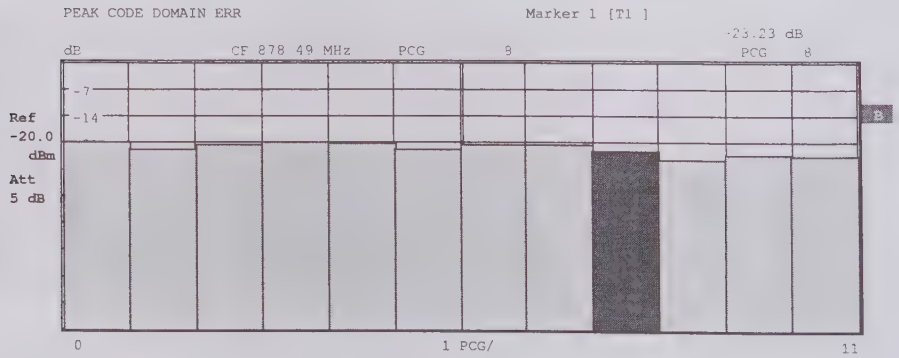
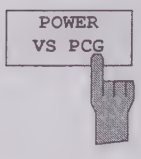


Fig. 6-14 Peak code domain error for the case of one channel not being detected as active

Similar to selecting a code channel in the CDP or CDEP diagram, there is the option in the peak code domain error diagram of selecting a PCG. The selection is performed by entering the PCG number (refer to the *SELECT PCG* softkey). The selected PCG is shown as a red bar.

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:ERR:PCDomain"`



The *POWER VS PCG* softkey enables the POWER versus power control group (PCG) evaluation.

In this instance the display of the power for the selected channel is averaged for each PCG and referred to the pilot power of the PCG. The unit on the y-axis is therefore dB PICH.

The measurement result consists of the numeric value per PCG for the power value. You can set the number of PCGs by means of the *CAPTURE LENGTH* softkey. Subsequently, the POWER VS PCG evaluation takes one code channel into account over the entire period of observation.

Note: *For the beginning of a power control group always to be detected correctly for a power-regulated signal, the external trigger must be used.*

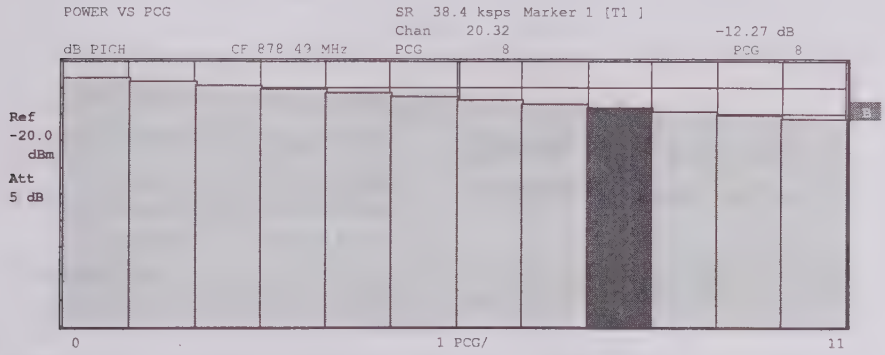


Fig. 6-15 Power versus time for an occupied channel with power control

Similar to selecting a code channel in the CDP or CDEP diagram, there is the option in the power versus PCG diagram of selecting a PCG. The selection is performed by entering the PCG number (refer to the *SELECT PCG* softkey). The selected PCG is shown as a red bar.

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:PVSLot"`

The *RESULT SUMMARY* softkey selects the numeric evaluation of all measurement results. The evaluation is subdivided as follows:

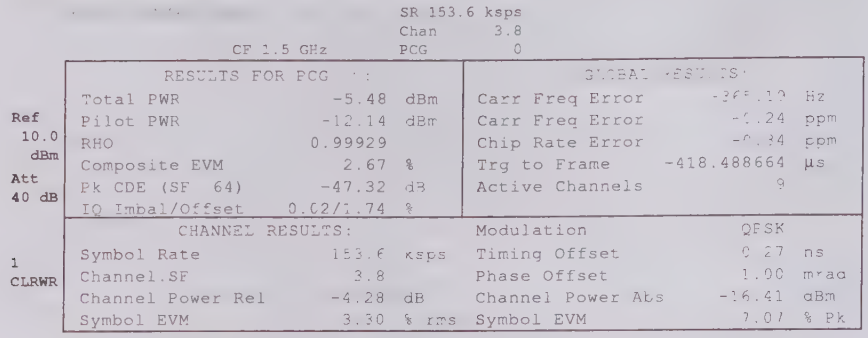


Fig. 6-16 Result summary

The top left part specifies the measurement results which concern the total signal (that is, all channels) for the power control group selected with the *SELECT PCG* softkey:

Total Power: Specifies the total power of the signal.

Pilot power: Specifies the pilot power. If antenna 2 (refer to *ANT NO* softkey) is selected, the power of the TDPICH is displayed, in all other cases that of the PICH.

RHO: Specifies RHO, the quality parameter. According to the cdma2000 standards, RHO is the normalized, correlated power between the measured and the ideally generated reference signal. When RHO is measured, the cdma2000 standards require that only the pilot channel be supplied.

Composite EVM: The composite EVM value is the difference between the test signal and the ideal reference signal (refer to the *COMPOSITE EVM* softkey).

Pk CDE: The *PEAK CODE DOMAIN ERR* measurement specifies a projection of the difference between the test signal and the ideal reference signal to the selected base spreading factor (refer to softkeys *PEAK CODE DOMAIN ERR* and *SELECT BASE SF*). The base spreading factor, to which the projection is made, is specified in addition to the measured value.

IQ Imbalance: IQ imbalance of the signal in %

IQ Offset: DC offset of the signal in %

The top right part specifies the measured results which concern the total signal (that is, all channels) for the entire period of observation (that is, all PCGs):

Carrier Freq Error:
Specifies the frequency error referred to the set center frequency of the analyzer. The absolute frequency error is the sum of the frequency error of the analyzer and that of the device under test. Frequency differences between the transmitter and receiver of more than 1.5 kHz impair synchronization of the CDP measurement. If at all possible, the transmitter and the receiver should be synchronized (refer to the Getting Started chapter). The frequency error is available in the unit hertz on the one hand and in ppm referred to the carrier frequency on the other.

Chip Rate Error: Specifies the chip rate error (1.2288 Mcps) in ppm. A large chip rate error results in symbol errors and, consequently,

possibly in the CDP measurement not being able to perform synchronization. This measurement result is also valid when the analyzer could not synchronize to the cdma2000 signal.

Trigger to Frame: This measurement result reflects the time offset from the beginning of the recorded signal section until the start of the first PCG. In the case of triggered data recording, this corresponds to the timing offset "frame trigger (+ trigger offset) – start of first PCG". If it was not possible to synchronize the analyzer to the cdma2000 signal, the value of Trg to Frame is meaningless. Is the trigger *FREE RUN* selected, dashes (-.--) are displayed.

No of Active Chan: Specifies the number of active channels found in the signal. In this case the detected data channels as well as the special channels are regarded as active. The result applies with transmit diversity to the selected antenna (refer to softkeys *ANT DIV* and *ANT NO.*).

The bottom part of RESULT SUMMARY presents the results of measurements on the selected channel and the selected PCG.

Symbol Rate: Symbol rate with which the channel is transmitted

Channel.SF: Number of the channel and its associated spreading factor

Modulation: Modulation type of the channel, BPSK, QPSK, 8-PSK or 16-QAM.

Timing Offset: Timing offset between the selected channel and the pilot channel. This measurement can be enabled by means of the *TIME/PHASE* softkey.

Phase Offset: Phase offset between the selected channel and the pilot channel. This measurement can be enabled by means of the *TIME/PHASE* softkey.

Chan Pow rel. / abs.:
Channel power relative (referred to the pilot or total power depending on the *POWER REF TOT/PICH*) softkey and the absolute channel power.

Symbol EVM Pk / rms:
Peak or mean value of the results of the error vector magnitude measurement (refer to the *SYMBOL EVM* softkey). The measurement provides information on the EVM of the selected channel for the selected PCG at symbol level.

If the *MAX/MIN HOLD* or *AVERAGE* trace statistics are enabled using the *TRACE* hardkey, the values are interlinked accordingly from one analysis to the next. The Active Channels, Symbol Rate and Channel.SF values are not statistically interlinked. In the case of the values which have an expectation value of 0 (Carr Freq Error, Trg to Frame, IQ Imbal/Offset, Timing and Phase Offset), the maximum value is formed in such a way that the maximum is sought among the absolute values and then output with sign. In this way it is possible to determine the largest deviation including the direction of the deviation. The minimum value is formed in the same way.

IEC/IEEE bus command:

```
:CALCulate2:FEED "XTIM:CDP:ERR:SUMM"
:CALCulate<1|2>:MARKer<1>:FUNCtion:CDPower[:BTS]:RESult?
            PTOTal | FERRor | RHO | PPICh | FERPpm |
            CERRor| TFRame | IQOFfset | IQIMbalance |
            MACCuracy | PCDerror | SLOT | ACTive | DMTYpe
            | SRATe | TOFFset | CHANnel | POFFset | SFACtor
            | CDPabsolute | CDPRelative |EVMRms |EVMPeak
```

The *CHANNEL TABLE* softkey selects the evaluation for the channel assignment table.
The channel assignment table may contain up to 128 entries, corresponding to the highest base spreading factor of 128. The channel assignment table evaluation takes the total signal into account over exactly one power control group. The power control group to be evaluated can be set by means of the *SELECT PCG* softkey.

The table lists first the special channels including the packet channels from 1xEV-DV then the data channels (CHAN) included in the signal are shown. The channels are sorted in descending order by symbol rate and in ascending order within a symbol rate by channel number. Unassigned codes are thus always at the end of the table.

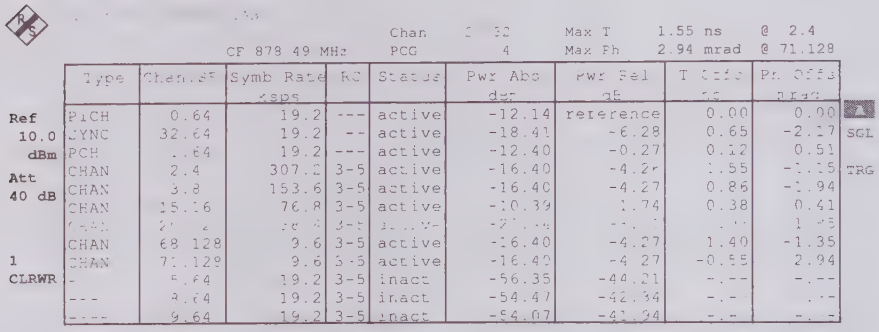


Fig. 6-17 Channel table

The following parameters are determined by the CDP measurement for the channels:

Type: Type of channel

Chan.SF: Number of the channel spreading code (0 to [spreading factor -1]) including the spreading factor of the channel in Chan.SF notation.

Symb Rate: Symbol rate with which the channel is transmitted (9.6 ksps to 307.2 ksps)

RC: Radio configuration

Status: Status display. Unassigned codes are identified as inactive channels.

Pwr Abs / Pwr Rel:
Specification of the absolute and relative (referred to the PICH or the total power of signal) power of the channel.

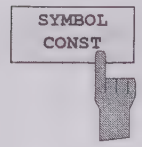
T Offs: Timing offset. The time offset between this channel and the pilot channel can be enabled by means of the *TIME/MEAS* softkey.

Ph Offs: Phase offset. The phase offset between this channel and the pilot channel can be enabled by means of the *TIME/MEAS* softkey.

A data channel in *CODE CHAN AUTOSEARCH* mode is defined as active when it exhibits a minimum power (refer to the *INACT CHAN THRESHOLD* softkey) and an adequate signal-to-noise ratio. In *CODE CHAN PREDEFINED* mode, all code channels contained in the channel table are marked as active.

If the TIME/PHASE softkey is set to ON, the maximum value of the TIMING and PHASE OFFSET is displayed together with the associated channel on the right-hand side above the channel table. Since the TIMING and PHASE values of each active channel can be either negative or positive, the absolute values are compared and the maximum is then displayed with the original sign.

IEC/IEEE bus command: `:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABle"`



The *SYMBOL CONST* softkey selects the evaluation of the constellation diagram at symbol level.
Evaluation of the symbols is performed for the selected channel (*SELECT CHANNEL* softkey) and the selected PCGs (*SELECT PCG* softkey). This evaluation thus takes into account the results of a channel for a power control group.

Evaluation of the constellation diagram is possible for unassigned codes, but the results are meaningless since unassigned code channels do not contain data.

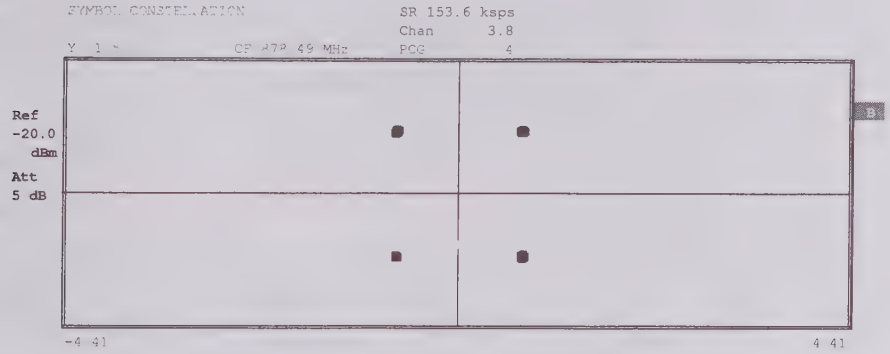
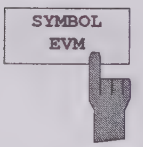


Fig. 6-18 Symbol constellation diagram

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:SYMB:CONS"`



The *SYMBOL EVM* softkey selects the evaluation for the symbol error vector magnitude. Evaluation of the EVM is performed for the selected channel (*SELECT CHANNEL* softkey) and the selected PCGs (*SELECT PCG* softkey). This evaluation thus takes into account the results of a channel for a power control group.

Evaluation of the symbol error vector magnitude for unassigned codes is possible, but the results are not meaningful.

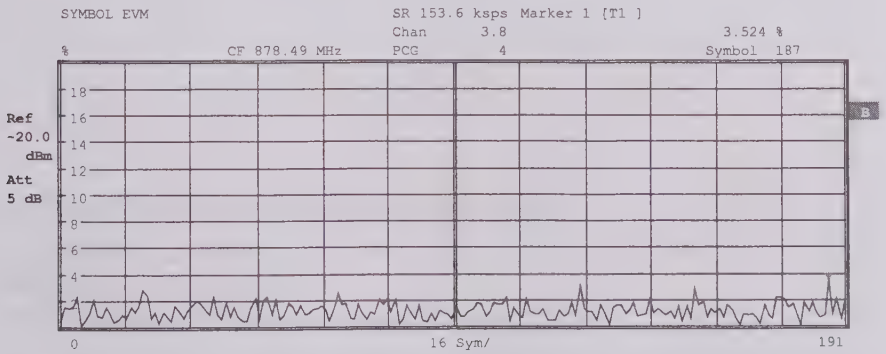


Fig. 6-19 Error vector magnitude for a PCG of a channel

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:SYMB:EVM"`

The *BITSTREAM* softkey selects the "Bitstream" evaluation .
Evaluation of the decided bits is performed for the selected channel (*SELECT CHANNEL* softkey) and the selected PCGs (*SELECT PCG* softkey). This evaluation thus takes into account the results of a channel for a power control group.

Depending on the symbol rate of the channel, a minimum of 12 and a maximum of 384 symbols can be contained in a power control group. In case of transmit diversity (sofkey *ANT DIV*) the values reduce to the half. For QPSK modulated channels, a symbol always consists of two bits: the I-component is displayed first, followed by the Q-component. For BPSK modulated channels, a symbol always consists of one bit (only the I-component is assigned). For 8-PSK and 16-QAM modulated symbols, a symbol consists of 3 and 4 bits respectively. The order is shown in the following figure:

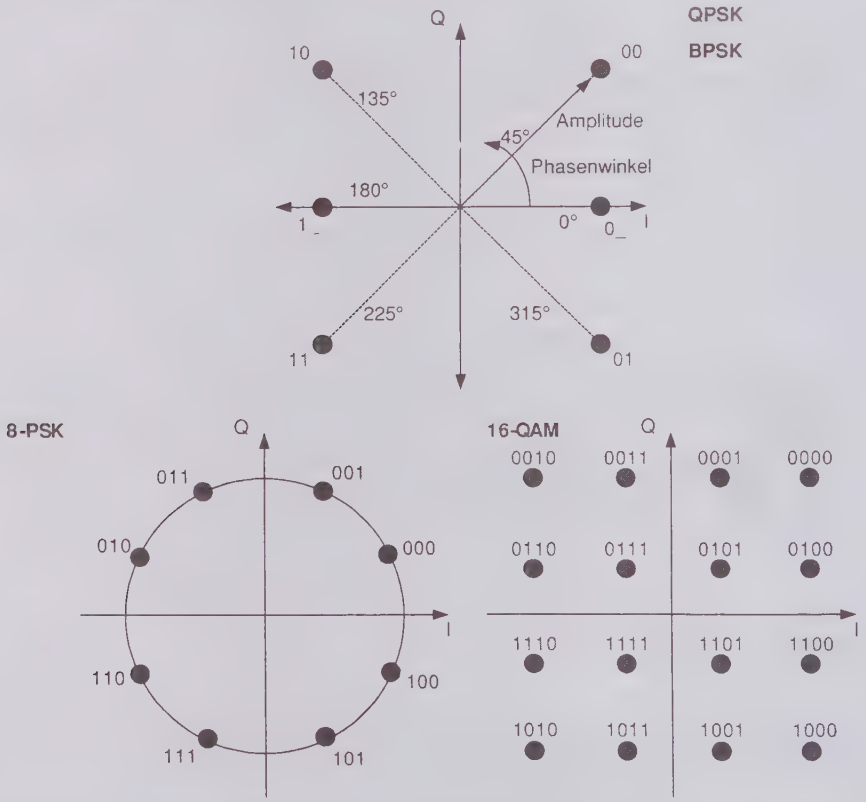


Fig. 6-20 Phasor diagram for QPSK, BPSK, 8-PSK and 16-QAM including bit values

In accordance with the radio configuration and the channel type, there are BPSK and QPSK modulated channels in the cdma2000 system.

Table 6-18 Relationship between channel type and modulation type

Channel type	Channel	Modulation
PICH	Pilot channel	BPSK
SYNC	Synchronisation channel	BPSK
PCH	Paging channel	BPSK
TDPICH	Transmit diversity pilot channel	BPSK
APICH	Auxiliary pilot channel	BPSK
ATDPICH	Auxiliary transmit diversity channel	BPSK
BCH	Broadcast channel	QPSK
CPCCH	Common power control channel	QPSK
CACH	Common assignment channel	QPSK
CCCH	Common control channel	QPSK
PDCCH	Packet data control channel	QPSK
PDCH	Packet data channel	QPSK, 8-PSK or 16-QAM
CHAN	Data channel radio configuration 1+2	BPSK
CHAN	Data channel radio configuration 3-5	QPSK

Evaluation of the bitstream for unassigned codes is possible, but the results are not meaningful on account of missing data; in this case all bits are marked as being invalid by means of '-'.

The marker can be used to scroll in the bitstream.

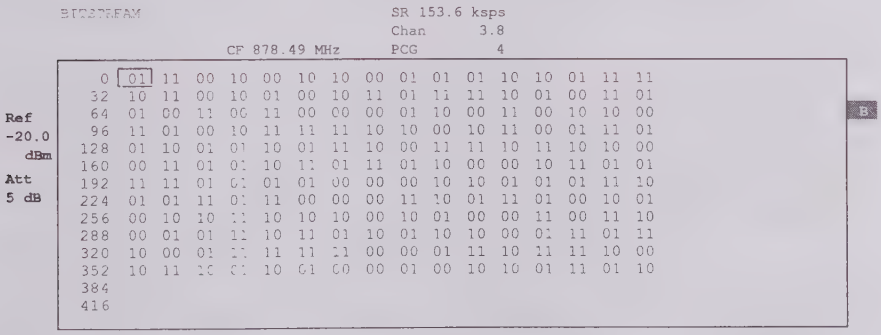


Fig. 6-21 Demodulated bits for a PCG of a channel

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:BSTReam"`

The *COMPOSITE CONST* softkey selects the evaluation of the constellation diagram at chip level.
With COMPOSITE CONST, the total signal is taken into account over the selected power control group (*SELECT PCG* softkey).
A constellation point is entered in the diagram for each of the 1536 chips.

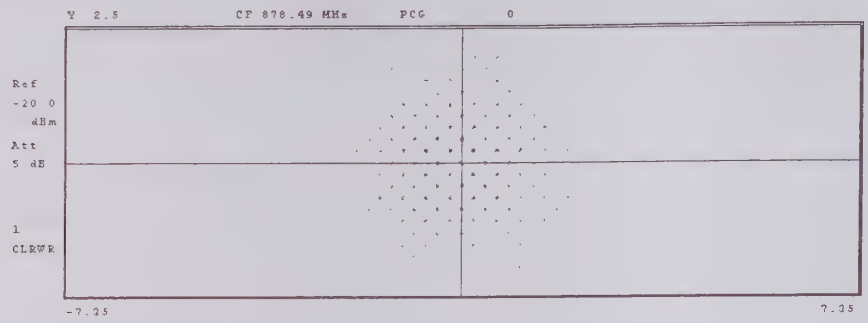


Fig. 6-22 Composite constellation diagram

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:COMP:CONS"`

POWER VS SYMBOL

The *POWER VS SYMBOL* softkey selects the power versus symbol evaluation. The evaluation outputs the absolute power in dBm at every symbol time for the selected channel (*SELECT CHANNEL* softkey) and the selected PCGs (*SELECT PCG* softkey). This evaluation thus takes into account the results of a channel for a power control group.

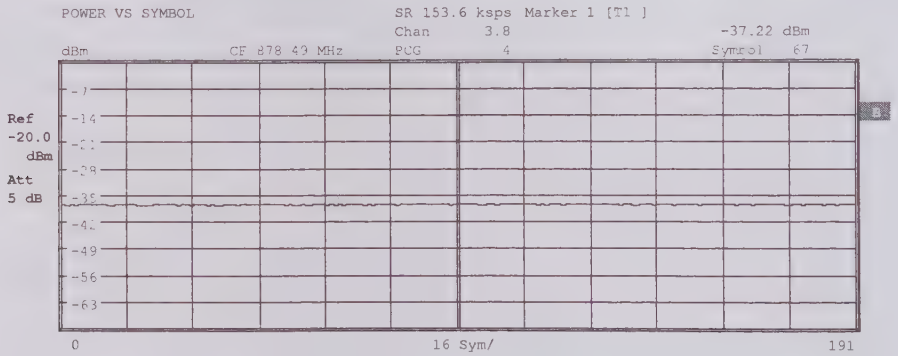


Fig. 6-23 Power versus symbol for a PCG of a channel

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:PVSY"`

SELECT CHANNEL

You can use the *SELECT CHANNEL* softkey to select a channel. All evaluations which take results for a channel into account, specify the results for the newly selected channel: POWER VS PCG, POWER VS SYMBOL, RESULT SUMMARY, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM.
In the evaluations CODE DOMAIN POWER, CODE DOMAIN ERROR POWER and CHANNEL TABLE (all on screen A), the selected channel is marked in red.

A channel is entered as a decimal. The entered value is always converted to the base spreading factor. It is displayed in the input field in the format <Channel>.<Base spreading factor>.

Example:

Let the base spreading factor be 64. (*BASE SF* softkey).
Enter the number 14 by means of the *SELECT CHANNEL* softkey.
14.64 is displayed.

Normally, the code is displayed with reference to the base spreading factor in the function field above the diagrams.

If the current channel table contains a concentrated channel to which the selected channel belongs with reference to the base spreading factor, this concentrated channel will be displayed with the associated code number and spreading factor in the function field and marked in red in the corresponding evaluations.

Example:

Enter the same details as in the example shown above.
Channel 2.4 is now active in the channel table.
The associated code is 14.64, i.e. 2.4 is displayed in the function field and channel 2.4 is marked in red on screen A.
In Hadamard order, all the codes belonging to channel 2.4 are marked: 2.62, 6.64, 10.64, **14.64**, ..., 62.64

If the channel configuration changes for the next measurement, the changed channel for which the channel <channel>.<base spreading factor> belongs is displayed in the function field and indicated in red on screen A.

Example:

Continuing with the above example, the channel configuration has been changed and now channel 6.8 is active.
Channel 6.8 is now displayed in the function field and
Marked in red on screen A. In Hadamard order, the codes 6.64, **14.64**, 22.64, ..., 54.64 are marked.

The rotating wheel behaviour depends on the evaluation on screen A and is geared to the graphic display. In the case of CODE DOMAIN POWER and CODE DOMAIN ERROR POWER, it depends on whether the Hadamard or BitReverse order is active. (Refer to the *ORDER* softkey.) The adjacent channel is always selected with the rotating wheel. With the channel table, the rotating wheel is used to scroll through the list.
Input over the IEC/IEEE bus generally refers to the base spreading factor.

IEC/IEEE bus command: `:[SENSe:]CDPower:CODE 0...(BASE SF-1)`

The *SELECT PCG* softkey is used to select a power control group. The PCG is entered as a decimal. In this instance the range is from 0 to (capture length-1), refer to the *CAPTURE LENGTH* softkey. All evaluations which take results for a PCG into account, specify the results for the newly selected PCG: (CODE DOMAIN POWER, CODE DOMAIN ERROR POWER, CHANNEL TABLE, POWER vs SYMBOL, COMPOSITE CONSTELLATION, RESULT SUMMARY, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM)

In the evaluations POWER vs PCG, COMPOSITE EVM and PEAK CODE DOMAIN ERROR the selected PCG is marked in red.

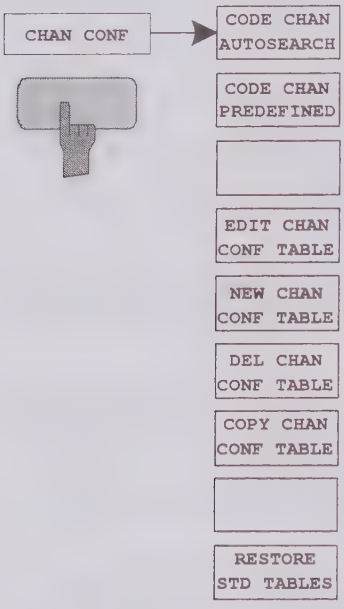
IEC/IEEE bus command: `:[SENSe:]CDPower:SLOT 0 ... (IQ_CAPTURE_LENGTH-1)`

The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without the analyzer being overloaded or the dynamic response being limited by a too low signal-to-noise ratio.

IEC/IEEE bus command: `SENS:POW:ACH:PRES:RLEV`

Measurement configuration

CHAN CONF hot key



The *CHAN CONF* hot key opens a submenu with the configuration options for the channel search. On this submenu, predefined channel tables can be selected and are then taken as a basis for measurements by the code domain analyzer.

When the hot key is selected, a table containing the channel tables stored on the hard disk of the measuring instrument is opened. The table is used merely to obtain an overview; one of the tables can be selected for the measurement only after the *CODE CHAN PREDEFINED* softkey has been operated. The *RECENT* entry is the channel table of the last code domain power analysis to be performed.

IEC/IEEE bus command:

```
:CONFigure:CDPower[:BTS]:CTABle:CATalog?
```

The *CODE CHAN AUTOSEARCH* softkey supports measurements of the code domain power analyzer in Autosearch mode. In this mode, the whole code domain (all permissible symbol rates and channel numbers) is searched for active channels. A channel is active when the minimum power entered by the user, referred to the total power, is exceeded (refer to the *INACT CHAN THRESHOLD* softkey) and an adequate signal-to-noise ratio is present.

CODE CHAN AUTOSEARCH mode is the default search mode with which the CDP analysis starts. It is used primarily to provide the user with an overview of the channels contained in the signal. If the signal contains channels which are not detected as being active in Autosearch mode, the CDP analysis can be performed with predefined channel configurations by changing to *CODE CHAN PREDEFINED* mode.

IEC/IEEE bus command:

```
:CONFigure:CDPower[:BTS]:CTABle[:STATe] OFF
```

The *CODE CHAN PREDEFINED* softkey switches the CDP analysis to the measuring mode with the help of predefined channel tables. In this mode there is no search for active channels in the code domain, but the channels of a channel table defined prior to a measurement are assumed to be active.

When the softkey is selected, a table containing all the channel tables stored on the measuring instrument is opened. The CDP analysis is switched to "Predefined Channel Table" mode. The last table of Autosearch mode is initially taken as a basis for the measurement. This table is available at the *RECENT entry* .

Switching to one of the predefined channel tables is done by selecting the corresponding table entry and operating one of the unit keys or by pressing Enter; the selected channel table is taken as a basis for the evaluation as from the next measurement. A tick marks the selected channel table.

R&S FS-K82 comes with the following channel table stored on the measuring instrument:

Channel table with PICH/SYNC/PCH and 6 data channels called **MPC_RC1**. (Base Station **M**ain **P**ath 6 **C**hannels **R**adio **C**onfiguration 1).

Channel table with PICH/SYNC/PCH and 6 data channels called **MPC_RC4**. (Base Station **M**ain **P**ath 6 **C**hannels **R**adio **C**onfiguration 4).

Channel table with PICH/TDPICH/SYNC/PCH and 6 data channels called **BPC_RC4**. (Base Station **B**oth **P**aths 6 **C**hannels **R**adio **C**onfiguration 4).

Channel table similar to MPC_RC4, but additionally with a PACKET DATA CONTROL CHANNEL and 11 PACKET DATA CHANNELs called **DV** due to the 1xEV-DV enhancement.

For a precise definition of the channel tables refer to Chapter 4.

If transmit diversity (two-antenna system) is used, the following test setups are possible:

A) Feeding of antenna 1 identical to the normal measurement without transmit diversity
B) Feeding of antenna 2
C) Feeding of the aggregate signal of both antennas

If a predefined channel table is used it must describe the feed in signal.

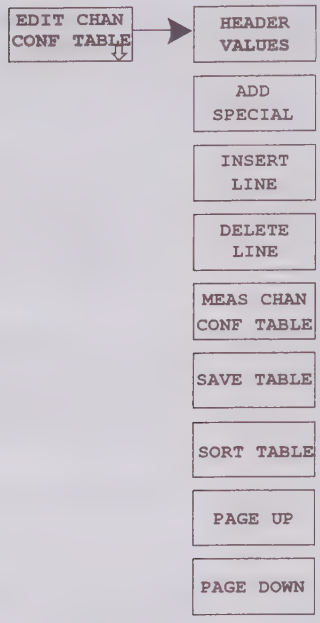
This means that in case A) the pilot channel PICH **must** be contained in the predefined channel table. The pilot channel of the antenna 2 TDPICH **must not** be included.

In case B) the pilot channel of antenna 2 TDPICH **must** be included in the predefined channel table. Pilot channel PICH **must not** be included.

In case C) the pilot channel PICH and the pilot channel of antenna 2 TDPICH **must** be included in the predefined channel table.

IEC/IEEE bus command:

```
:CONFigure:CDPower[:BTS]:CTABle[:STATe] ON
:CONFigure:CDPower[:BTS]:CTABle:SELect "MPC_RC4"
```



The *EDIT CHAN CONF TABLE* softkey opens the selected channel table in which the channel configuration can be modified. In addition, a submenu is opened with the softkeys required for editing the channel table.

EDIT CHANNEL TABLE

NAME	MPC_RC4				
COMMENT:	Base Station Main Path 6 Channels RC4				
TYPE	CHAN.SF	SYMBOL RATE [ksps]	RC	CDP REL [dB]	STATUS
PICH	0 64	19 2	-	0 0	ACTIVE
SYNC	32.64	19 2	-	0.0	ACTIVE
PCH	1 64	19 2	-	0 0	ACTIVE
CHAN	9.128	9 6	4	0 0	ACTIVE
CHAN	10 128	9 6	4	0 0	ACTIVE
CHAN	11 128	9 6	4	0 0	ACTIVE
CHAN	15 128	9 6	4	0 0	ACTIVE
CHAN	17.128	9 6	4	0.0	ACTIVE
CHAN	25 128	9 6	4	0 0	ACTIVE

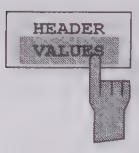
Fig. 6-24 Table for editing a channel configuration

As a general rule, each of the channel tables stored on the measuring instrument can be modified at will. The edited table is not stored automatically on the hard disk of the measuring instrument but only by selecting the *SAVE TABLE* softkey. This prevents a table from being accidentally overwritten (such as one of the channel models).

If a table is edited that is currently the basis for the code domain power analysis, the edited table is used for the next measurement immediately after being saved. The effects of the changes in the table are therefore immediately visible. Here again, the edited table is not saved on the hard disk of the measuring instrument until the *SAVE TABLE* softkey has been selected.

If a table that is stored on the hard disk of the measuring instrument but is not currently enabled is edited, the changes will not be visible until it has been saved (*SAVE TABLE* softkey) and then enabled.

If the CHAN NO parameter or the spreading factor of a channel is changed, a check is made for code domain conflicts after the input has been confirmed (units key). If a code domain conflict is detected, the channels causing the conflict are identified by an asterisk. The user is thus given an opportunity to eliminate the code domain conflicts. When a table with code domain conflicts is used for a CDP analysis, the results are invalid.



The *HEADER/VALUES* softkey sets the focus of the edit option either to the entries in the table or to the table header.

Editing the table header (*HEADER*):
Overwriting of saved tables can be avoided by changing the name of a table. A table name must not consist of more than 8 characters.

IEC/IEEE bus command:

```
:CONFigure:CDPower[:BTS]:CTABle:NAME "NEW_TAB"
```

Editing table entries (*VALUES*):
The actual data of the channel table are edited here. The following entries are available for each of the channels contained in the table (confirm an input with the help of the units keys):

TYPE: Channel type. Special channels are identified by name (PICH, SYNC, PCH, TDPICH, APICH, ATDPICH, BCH, CPCCH, CACH, CCCH, PDCCH and PDCH). All other channels contain the CHAN entry for normal data channels.

CHAN.SF: The channel number and the spreading factor are entered for the channel in this column. If no decimal point is entered, the base spreading factor is used for the channel spreading factor (refer to the *BASE SF* softkey). Invalid entries are rejected.

SYMBOL RATE: Symbol ratewith which the channel is transmitted. It depends directly on the spreading factor of the channel (refer to Table 6-17) and therefore cannot be edited.

RC: Radio configuration, cannot be edited for special channels '-'. For data channels (CHAN) values between 1 and 5 can be entered. The AUTO Search mode differentiates between the 1&2 (for which BPSK data channels are modulated) and RC 3 to 5 (for which QPSK data channels are modulated).
For PACKET DATA CHANNEL (PDCH) the radio configuration is 10 (QPSK), 10 (8-PSK) or 10 (16-QAM) depending on the requested modulation type.

CDP REL.: Informative entry of the relative channel power (referred to the pilot or total power depending on the *POWER REF TOT/PICH* softkey). The entry cannot be edited and only exists for the *RECENT* table; it is used to detect channels with low power.

STATUS: Status of the channel (active/inactive). When a change of channel status occurs, a channel that has been entered in the table can be hidden in the code domain power analysis without having to remove the corresponding entry from the table. Only channels having an "active" channel status are used for the CDP analysis.

IEC/IEEE bus commands:

```
:CONFigure:CDPower[:BTS]:CTABle:DATA
0,6,0,0,0,0,1,0.0,
10,5,3,4,0,0,1,0.0
```

'Select PICH 0.64 and data channel with RC4/Walsh code 3.32.

```
:CONFigure:CDPower[:BTS]:CTABle:COMMent
```

"Comment for new table"

The *ADD SPECIAL* softkey allows special channels to be added to the channel table.

ADD SPECIAL CHANNEL	
PICH	Pilot Channel
SYNC	Synrchonisation Channel
PCH	Paging Channel
TDPICH	Transmit Diversity Channel
APICH	Auxiliary Pilot Channel
ATDPICH	Auxiliary Transmit Diversity Pilot Channel
BCH	Broadcast Channel
CPCCH	Common Power Control Channel
CACH	Common Assigment Channel
CCCH	Common Control Channel
PDCCH	Packet Data Control Channel
PDCH	Packet Data Channel

Fig. 6-25 Table of special channels

All channels not listed are entered as CHAN by means of the *Insert Line* softkey.

If transmit diversity (two-antenna system) is used, the following test setups are possible:

A) Feeding of antenna 1 identical to the normal measurement without transmit diversity
B) Feeding of antenna 2
C) Feeding of the aggregate signal of both antennas

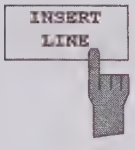
If a predefined channel table is used, the feed signal must fulfill the following conditions:

In case A) the pilot channel PICH **must** be contained in the predefined channel table. The pilot channel of the antenna 2 TDPICH **must not** be included.

In case B) the pilot channel of antenna 2 TDPICH **must** be included in the predefined channel table. Pilot channel PICH **must not** be included.

In case C) pilot channel PICH **and** the pilot channel of antenna 2 TDPICH **must** be included in the predefined channel table.

IEC/IEEE bus command: -- (integrated in command
:CONFigure:CDPower[:BTS]:CTABle:DATA)

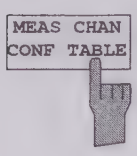


The *INSERT LINE* softkey adds a new entry to the table. Entries can be made in any order. A channel is only included in the CDP analysis if all required entries are present in the list.

IEC/IEEE bus command: --

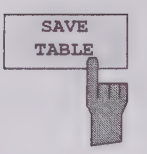
The *DELETE LINE* softkey deletes the selected line from the table.

IEC/IEEE bus command: --



The *MEAS CHAN CONF TABLE* softkey initiates a measurement in *CODE CHAN AUTOSEARCH* mode. The measurement results are applied to the open channel table. The softkey is only available in *CODE CHAN AUTOSEARCH* mode.

IEC/IEEE bus command: --



The *SAVE TABLE* softkey saves the table with its specified name.
Note: Editing of the channel models and saving with the original name results in the models being overwritten.

IEC/IEEE bus command: -- (automatic with remote control)

The *SORT TABLE* softkey sorts the table in ascending order by spreading factor and in ascending order within a spreading factor by channel number.

IEC/IEEE bus command: --

The *DEL CHAN CONF TABLE* softkey deletes the selected table. The current table in *CODE CHAN PREDEFINED* mode cannot be deleted.

IEC/IEEE bus command:

```
:CONFigure:CDPower[:BTS]:CTABle:DELete
```

The *COPY CHAN CONF TABLE* softkey copies the selected table. The system asks the name under which you want to save the copy.

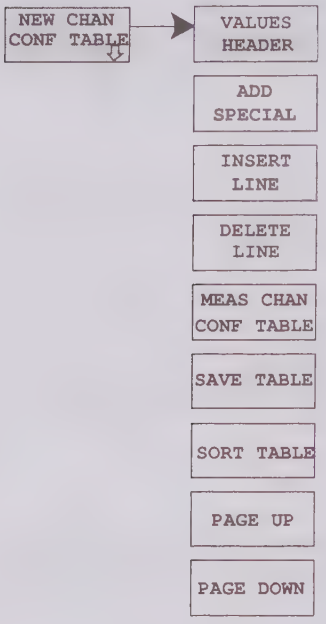
IEC/IEEE bus command:

```
:CONFigure:CDPower[:BTS]:CTABle:COPY "CTAB2"
```

The *RESTORE STD TABLES* softkey restores the predefined channel tables including all of their values (refer to Chapter 4) to the state in which they were in when the device left the factory. In this way unintentional overwriting can be undone.

IEC-bus command::

```
CONFigure:CDPower:CTABle:RESTore
```



The *NEW CHAN CONF TABLE* softkey opens a submenu that is identical with that described for the *EDIT CHAN CONF TABLE* softkey. Unlike *EDIT CHAN CONF TABLE*, however, only the pilot channel PICH is included in the table with *NEW CHAN CONF TABLE*; the name of the table is similarly still undefined:

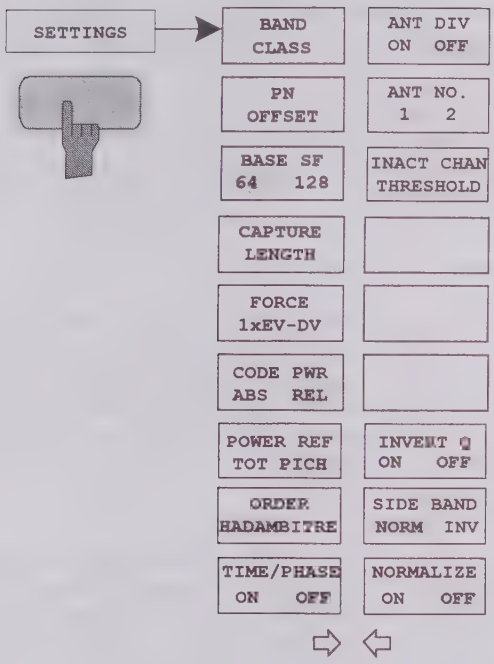
EDIT CHANNEL TABLE

NAME					
COMMENT					
TYPE	CHAN SF	SYMBOL RATE [ksps]	PC	CDF REL [dB]	STATUS
PICH	C 64	19.2	-	C 0	ACTIVE

Fig. 6-26 Creating a new channel configuration

Configuring the firmware application – SETTINGS

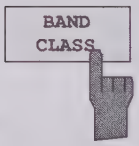
SETTINGS hot key



The *SETTINGS* hot key opens a submenu for setting the measurement parameters of the firmware application.

The *BAND CLASS* softkey is a setting parameter for the RF measurements "adjacent channel power" and "spectrum emission mask".

All other softkeys configure the measurements in the code domain analyzer.



The *BAND CLASS* softkey supports entry of the frequency band used for the RF measurements "adjacent channel power" and "spectrum emission mask". The selection is made from a table in which the name of the band class is displayed.
The center frequency entry is not restricted by the selected band class.

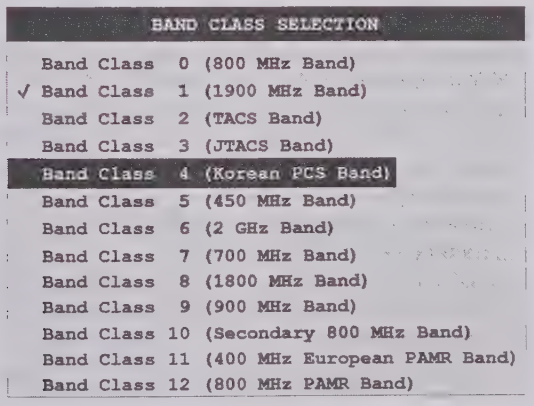
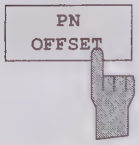

BAND CLASS SELECTION
Band Class 0 (800 MHz Band)
✓ Band Class 1 (1900 MHz Band)
Band Class 2 (TACS Band)
Band Class 3 (JTACS Band)
Band Class 4 (Korean PCS Band)
Band Class 5 (450 MHz Band)
Band Class 6 (2 GHz Band)
Band Class 7 (700 MHz Band)
Band Class 8 (1800 MHz Band)
Band Class 9 (900 MHz Band)
Band Class 10 (Secondary 800 MHz Band)
Band Class 11 (400 MHz European PAMR Band)
Band Class 12 (800 MHz PAMR Band)

Fig. 6-27 Band class selection

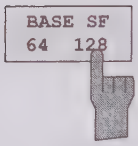
The user can scroll in the table, and the entry currently being used is checked, while a bar displays the selected entry; click ENTER to apply the value.
The numerical value is specified over the IEC/IEEE bus.

IEC/IEEE bus command: `:CONFigure:CDPower:BCLass 1 '1900 MHz`



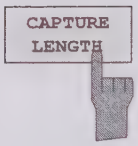
The *PN OFFSET* softkey supports input of the PN offset of the base station, which is used to distinguish the base stations within a cdma2000 system.
The PN offset determines the offset in the circulating PN sequence in multiples of 64 chips with reference to the event second clock trigger.

IEC/IEEE bus command: `:[SENSe:]CDPower:PNOFfset 0...511`



The *BASE SF* softkey selects the base spreading factor as 64 or 128. If channels of spreading factor 128 are being analyzed, the base spreading factor of 128 should be used since, when base spreading factor 64 is used, alias power is displayed in the CODE DOMAIN POWER and CODE DOMAIN ERROR POWER diagrams. (Refer to the colours for these evaluations.)

IEC/IEEE bus command: `:[SENSe:]CDPower:SFACtor 64 | 128`



The *CAPTURE LENGTH* softkey supports input of the number of power control groups (PCG) that are to be analyzed. The input value is always in multiples of the PCGs. The range is from 2 to 50 for Analyzer R&S FSU, R&S FSQand from 2 to 12 for Analyzer R&S FSP. With all evaluations exhibiting one value per PCG on the x-axis, the maximum value on the x-axis is the set CAPTURE LENGTH -1.

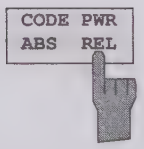
IEC/IEEE bus command: `:[SENSe:]CDPower:IQLength 2..50 (2..12)`

The *FORCE 1xEV-DV* softkey is necessary in the automatic search mode to support the channel detection. If there is a QPSK modulated channel with spreading-factor 32 it is not possible to distinguish whether it is a data channel (CHAN with radio configuration 3-5) or a PACKET DATA CHANNEL (PDCH with radio configuration 10). This decision is made for the PDCH of the 1xEV-DV system if the softkey is active. If the softkey is not active (default) the CHAN is detected.

IEC/IEEE bus command: `:[SENSe:]CDPower:FDV ON | OFF`

The *INACT CHAN THRESHOLD* softkey supports input of the minimum power which a single channel must have compared with the total signal in order to be regarded as the active channel.
Channels below the specified threshold are regarded as "inactive".
The two measurements *COMPOSITE EVM* and *PEAK CODE DOMAIN ERR*, which are specified as measurements on the total signal, are performed using the list of active channels. Distortions of these two measurements always occur when active channels are not detected as being active and unassigned codes are wrongly given the status of "occupied channel". *INACT CHAN TRHESHOLD* can therefore be used to influence the results of the two measurements.
The default value is –60 dB, which results in location of all channels by the CDP analysis with signals such as the cdma2000 test models. If not all channels contained in the signal are detected automatically, *INACT CHAN THRESHOLD* must be decreased.

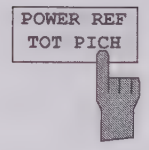
IEC/IEEE bus command:
`:[SENSe:]CDPower:ICTReshold -100 dB ... 0 dB`



The *CODE PWR ABS/REL* softkey selects for the CODE DOMAIN POWER evaluation whether the y-values should be displayed as absolute (dBm) or relative (dB). With Relative mode, the reference is either the total power or the pilot power. With *ANT OFF* and *ANT NO 1*, the PICH is the reference of the pilot power; with *ANT NO 2* it is the TDPICH

IEC/IEEE bus command: `:CALCulate<1>:FEED "XPOW:CDP:RAT"`
(relative)

:CALCulate<1>:FEED "XPOW:CDP"
(absolute)



The *POWER REF TOT/PICH* softkey determines the reference power for the relative power evaluations:

TOT All relative power values (*CDP RELATIVE* and *POWER VS PCG* evaluations) are referred per PCG to the total power of the signal in the PCG concerned.

PICH The reference power is that of the PICH, or in the case of ANT NO. 2, that of the TDPICH in the corresponding PCG.

The default setting of the softkey is *PICH*.

Since PCG-oriented power control is planned for each channel according to cdma2000, the total power of the signal will vary from PCG to PCG in accordance with the power controls of the different channels. With enabled power control and reference to the total power of the signal, a relative CDP evaluation by means of the PCG number (*POWER VS PCG*) does therefore not necessarily reflect the power control of the selected channel.
Example (theoretical): If there is just one data channel in the signal and its power is controlled, and if the power is referred to the total power of the signal (which consists only of the contribution from this one data channel), a straight line will appear in the *POWER VS PCG* diagram instead of the expected power staircase. The reference value *TOT* of the relative evaluations is therefore only meaningful if the signal does not contain power control.
The *PICH* setting, by contrast, reflects the precise variation of power for each PCG in a selected channel even for signals with power control. Since the PICH is not subject to power control under any circumstances, the same reference value is used in every PCG.

IEC/IEEE bus command: `:[SENSe:]CDPower:PREFerence TOTal | PICH`

The *ORDER HADAM/BITRE* softkey makes it possible to define the channel sort for the CODE DOMAIN POWER and CODE DOMAIN ERROR POWER evaluations. With Hadamard order (softkey at HADAM), the codes are sorted in ascending order. With BitReverse order (softkey at BITRE), channels with concentrated codes are next to one another, since the code numbers are sorted in bit-reversed order. (Refer to the CODE DOMAIN POWER and CODE DOMAIN ERROR POWER evaluations.)

IEC/IEEE bus command:
`:[SENSe:]CDPower:ORDer HADamard | BITReverse`

The *TIME/PHASE ON/OFF* softkey supports the enabling and disabling of the timing and phase offset evaluation of the channels to the pilot. If the value of the softkey is OFF (default setting) or more than 50 active channels are in the signal, dashes ('---') are entered in the channel occupation table and in the result summary evaluation for the timing and phase offsets. If the softkey is ON, the evaluation will take place and the values will be displayed.

IEC/IEEE bus command: `:[SENSe:]CDPower:TPMeas ON | OFF`

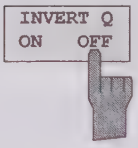
The *ANT DIV* (Antenna Diversity) softkey supports enabling and disabling of orthogonal transmit diversity (two-antenna system). The default setting of the softkey is OFF. If the value is at ON, the firmware application measures transmit diversity signals. The *ANT NO* softkey becomes available.

The *ANT NO.* softkey is used to select the antenna for which the evaluation is required to be performed. With transmit diversity, the signal of antenna 1 or the signal of antenna 2 or the aggregate signal from both antennas is fed in. The softkey is merely used to select the antenna for which results will be displayed.

On antenna 1, the pilot channel PICH with channel number 0 and spreading factor 64 (0.64) is required.
On antenna 2, the transmit diversity pilot channel TDPICH with channel number 16 and spreading factor 128 (16.128) is requierd.

For a correct entry of the predefined channel table with transmit diversity, refer to the *CODE CHAN PREDEFINED* softkey.

IEC/IEEE bus command: `:[SENSe:]CDPower:ANTenna OFF | 1 | 2`



The *INVERT Q* softkey inverts the sign of the Q-component of the signal. The default setting is OFF.

IEC/IEEE bus command: `[:SENSe]:CDP:QINVert OFF`

The *SIDEBAND NORM / INV* softkey chooses between measurement of the signal in normal (NORM) and inverted spectral position (INV).

NORM The normal position allows measurement of base station RF signals.

INV The inverted position is practical for measurements on IF modules or components in the case of spectral inversion.

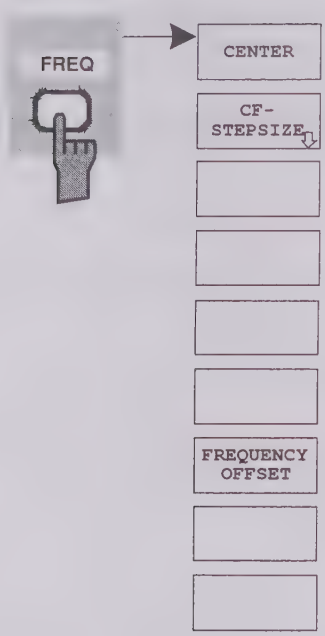
The default setting is NORM.

IEC/IEEE bus command: `:[SENSe:]CDPower:SBANd NORMal|INVers`

The *NORMALIZE ON / OFF* softkey eliminates the DC offset from the signal. The default setting of the parameter is OFF.

IEC/IEEE bus command: `:[SENSe:]CDP:NORMalize OFF`

Frequency settings – *FREQ* key



The *FREQ* key opens a submenu for changing the measurement frequency.

The *CENTER* softkey opens the input window for manually entering the center frequency.
The permissible input range of the center frequency is

$$Minspan/2 \leq f_{center} \leq f_{max} - Minspan/2$$

f_{center}	center frequency
Minspan	smallest selectable span >0 Hz (10 Hz)
f_{max}	maximum frequency

IEC/IEEE bus command: `FREQ:CENT 100MHz`

CF-STEPSIZE opens a submenu for setting the step size of the center frequency change. There is an option of entering the step size manually (*MANUAL* softkey) or using the current measurement frequency (*CENTER* softkey). The softkeys are described in the manual for the basic unit.

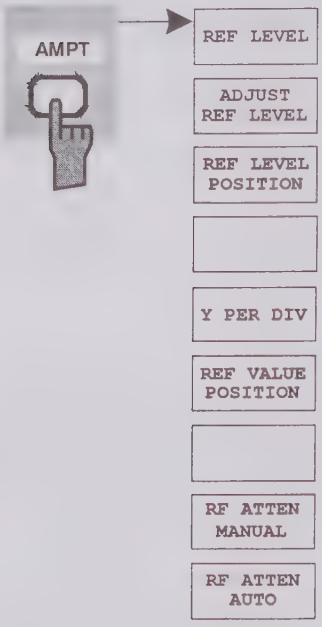
The *FREQUENCY OFFSET* softkey enables entry of an arithmetic frequency offset which is added to the frequency axis labelling. The range for the offset is -100 GHz to 100 GHz. The default setting is 0 Hz.

IEC/IEEE bus command: `FREQ:OFFS 10 MHz`

Span settings – *SPAN* key

The *SPAN* key is disabled for measurements in the code domain analyzer. For all other measurements (refer to the MEAS key), the permissible span settings are explained for the measurement concerned. The associated menu corresponds to that of the measurement in the basic unit and is described in the manual for the basic unit.

Level settings – *AMPT* key



The *AMPT* key opens a submenu for setting the reference level.

The *REF LEVEL* softkey enables entry of the reference level. The entry is performed in dBm.

IEC/IEEE bus command:

```
DISP:WIND:TRAC:Y:RLEV -60dBm
```

ADJUST REF LEVEL executes a routine for optimum adaptation of the reference level to the signal.

IEC/IEEE bus command:

```
[SENSe<1|2>:]CDPower:LEVel:ADJust
```

The *REF LEVEL OFFSET* softkey enables entry of an arithmetic level offset. This is added to the measured levelirrespective of the selected unit. The Y-axis scaling is changed accordingly.
The setting range is ±200 dB in steps of 0.1 dB.

IEC/IEEE bus command:

```
DISP:WIND:TRAC:Y:RLEV:OFFS -10dB
```

Y PER DIV sets the grid spacing on the y-axis for all diagrams in which this is possible.

IEC/IEEE bus command:

```
:DISPlay[:WINDow<1|2>]:TRACe<1..3>:Y[:SCALe]:RPOSition
```

REF VALUE POSITION supports entry of the position of the y-axis reference value on the axis (0 to 100%).

IEC/IEEE bus command:

```
:DISPlay[:WINDow<1|2>]:TRACe<1..3>:Y[:SCALe]:PDIVision
```

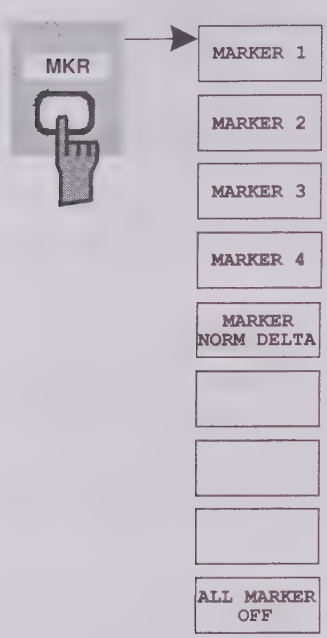
The *RF ATTEN MANUAL* softkey enables entry of the attenuation, irrespective of the reference level.
If the required reference level can no longer be set for the given RF attenuation, it will be adjusted and the message "Limit reached" will be issued.

IEC/IEEE bus command: `:INP:ATT 40 DB`

The *RF ATTEN AUTO* sets the RF attenuation automatically irrespective of the set reference level.
This ensures that the optimum attenuation desired by the user is always used.
RF ATTEN AUTO is the default setting.

IEC/IEEE bus command: `:INP:ATT:AUTO ON`

Marker settings - *MKR* key



The *MARKER* key opens a submenu for the marker settings.

Markers are not available for the *RESULT SUMMARY* and *CHANNEL TABLE* evaluations. Up to four markers can be enabled in all other evaluations and defined as markers or delta markers with the help of the *MARKER NORM/DELTA* softkey.

The *MARKER 1/2/3/4* softkeys select the marker concerned and enable it simultaneously.
Marker 1 is always the normal marker after it has been enabled, while markers 2 to 4 are delta referring to marker 1 after they have been enabled. The *MARKER NORM DELTA* softkey can be used to transform these markers into markers with absolute measure value display. If marker 1 is the active marker, *MARKER NORM DELTA* is enabled as an additional delta marker.
Pressing the *MARKER 1* to *MARKER 4* softkeys disables the selected marker.

IEC/IEEE bus command:
```
:CALC:MARK ON;
:CALC:MARK:X <value>;
:CALC:MARK:Y?
:CALC:DELT ON;
:CALC:DELT:MODE ABS|REL
:CALC:DELT:X <value>;
:CALC:DELT:X:REL?
:CALC:DELT:Y?
```

The *ALL MARKER OFF* softkey disables all markers (reference and delta markers). It also disables the functions and displays associated with the markers and delta markers.

IEC/IEEE bus command: `:CALC:MARK:AOFF`

The parameters relating to an enabled marker are read out above the diagrams:

```
Marker 1 [T1]
                          -5.00 dB
PCG  3 SR  19.2 ksps        1.64
```

Fig. 6-28 Marker field of diagrams

Apart from the channel power, which is displayed relative to the value specified at *POWER REF TOT/PICH*, the channel parameters are specified. The meanings are as follows (for the channel assigned to the marker):

PCG 03:	PCG number of the channel
SR 19.2 ksps:	Symbol rate of the channel (for unassigned codes 9.6 ksps)
1.64:	Walsh code number and spreading factor of the channel

For all other measurements not belonging to the code domain analyzer the marker functions of the basic unit apply.

Changing instrument settings – *MKR→* key

SELECT MARKER
PEAK
NEXT PEAK
PEAK MODE MIN MAX
PICH
TDPICH

The *MKR→* key opens a submenu for marker functions:

The *SELECT MARKER* softkey selects the desired marker in a data input field. If the marker is disabled, it is enabled and can then be moved. You enter a number. Delta marker 1 is selected by entering '0'.

IEC/IEEE bus command
```
:CALC:MARK1 ON;
:CALC:MARK1:X <value>;
:CALC:MARK1:Y?
```

The *PEAK* softkey sets the active marker or delta marker to the maximum/minimum of the associated trace.
If no marker had been active before the *MKR->* menu was opened, marker 1 is automatically enabled and the Peak function is executed.

IEC/IEEE bus command:
```
.CALC:MARK:MAX
.CALC:DELT:MAX
.CALC:MARK:MIN
.CALC:DELT:MAX
```

The *NEXT PEAK* softkey sets the active marker or delta marker to the next lower maximum/minimum value of the associated trace. The search direction is specified by the setting in the *NEXT MODE LEFT/RIGHT* submenu.

IEC/IEEE bus command:
```
CALC:MARK:MAX:NEXT
CALC:DELT:MAX:NEXT
CALC:MARK:MIN:NEXT
CALC:DELT:MIN:NEXT
```

The *PEAK MODE MIN/MAX* softkey sets whether the peak search should determine the maximum or minimum value of the trace. The parameter affects the response of the *PEAK* and *NEXT PEAK* softkeys.

IEC/IEEE bus command: `--`

The *MARKER → PICH* softkey sets the marker to the pilot channel (channel number 0.64).

IEC/IEEE bus commands:
```
:CALCulate<1|2>:MARKer<1>:FUNCtion:PICH
:CALCulate<1|2>:MARKer<1>:Y?
```

The *MARKER → TDPICH* softkey sets the marker to the transmit diversity pilot channel (channel number 16.128 for base spreading factor 128. If base spreading factor 64 is selected, the marker is set to channel 16.64).

IEC/IEEE bus commands:
```
:CALCulate<1|2>:MARKer<1>:FUNCtion:TDPich
:CALCulate<1|2>:MARKer<1>:Y?
```

Marker functions – MKR *FCTN* key

The *MKR FCTN* key is disabled for all measurements in the code domain analyzer. The softkeys of the menu are described in the manual of the basic unit for all other measurements of the R&S FS-K82.

Bandwidth setting – *BW* key

The *BW* key is disabled for all measurements of the code domain analyzer. The softkeys associated with the menu are described in the manual of the basic unit for all other measurements of the R&S FS-K82.

Measurement control – *SWEEP* key

The menu of the *SWEEP* key contains options for switching between single measurement and continuous measurement and for the control of individual measurements. For measurements in the spectral range, the measurement time for a sweep and the number of sweep points can also be set. All the softkeys associated with the menu are described in the manual of the basic unit.

Measurement selection – *MEAS* key

The menu of the *MEAS* key contains all the measurements that can be selected at the pressing of a key in the R&S FS-K82. The menu and its submenus are described in Chapter 0.

Trigger settings – *TRIG* key

The selectable trigger options depend on the measurement selected. For the code domain power analyzer, Free Run mode and the external even-second clock trigger mode specified by the cdma200 standard are possible. The trigger options for all other measurements are identical to those of the corresponding measurement in the basic unit. The associated softkeys are described in the manual for the basic unit.

Trace settings – *TRACE* key

The *TRACE* key opens the following submenu:

The *CLEAR/WRITE* softkey enables Overwrite mode for the acquired measured values, i.e. the trace is rewritten for each sweep.
After the *CLEAR/WRITE* softkey has been operated, the unit deletes the selected trace memory and restarts the measurement.

IEC/IEEE bus command: `DISP:WIND:TRAC:MODE WRIT`

The *MAX HOLD* softkey activates the peak value detector.
The analyzer only accepts the new measured value into the saved trace data if it is larger than the previous one.
Pressing the *MAX HOLD* softkey a second time deletes the trace memory and starts peak value detection from the beginning again.

IEC/IEEE bus command: `DISP:WIND:TRAC:MODE MAXH`

The *MIN HOLD* softkey activates the minimum value detector
The analyzer only accepts the new measured value into the saved trace data if it is smaller than the previous one.
Pressing the *MIN HOLD* softkey a second time deletes the trace memory and starts minimum peak detection from the beginning again.

IEC/IEEE bus command: `DISP:WIND:TRAC:MODE MINH`

The *AVERAGE* softkey enables the trace averaging function. The average value is formed over several sweeps. Averaging is performed irrespective of the AVG MODE LOG / LIN setting on the logarithmic level values or on the measured power/voltage values.
Averaging is restarted every time the *AVERAGE* softkey is pressed. The trace memory is always cleared.

IEC/IEEE bus command: `DISP:WIND:TRAC:MODE AVER`

For the measurements in the code domain analyzer, an AVERAGE/ MAX HOLD or MIN HOLD is possible.
For the measurements in the code domain analyzer, an AVERAGE/ MAX HOLD or MIN HOLD is possible.
In the evaluation channel occupation table the measured channel configuration of the first sweep is retained for the trace statistic.
If the signal configuration changes, the Softkey SINGLE SWEEP (and under circumstances CONTINOUS SWEEP) needs to be pressed.
The evaluations RESULT SUMMARY, BITSTREAM and the CONSTELLATION diagrams only support CLEAR WRITE mode.

The *SWEEP COUNT* softkey sets the number of sweeps used for averaging. The permissible range is 0 to 30000, though the following

should be noted:

Sweep Count = 0	means running averaging with averaging length of 10
Sweep Count = 1	means no averaging
Sweep Count > 1	averaging over the specified number of sweeps; in continuous sweep mode averaging changes over to running averaging once this number has been reached.

The default setting is running averaging (Sweep Count = 0). The number of sweeps used for averaging is always equal to the averaging length of 10 for all active traces in the selected diagram.

IEC/IEEE bus command: `SWE:COUN 64`

Display lines – *LINES* key

The *LINES* key*is disabled for all measurements in the code domain analyzer. The menu setting options for all other measurements are equivalent to those of the corresponding measurement in the basic unit. The respective softkeys are described in the manual for the basic unit.*

Measurement screen settings – *DISP* key

The menu of the *DISP* key contains softkeys for configuring the measurement screen. The menus and the softkey properties are described in the manual of the basic unit.

Storing and loading of unit data – *FILE* key

The *FILE menu* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit.

Preset of device – *PRESET* key

The *PRESET* key presets the device. The behaviour is the same as of the basic unit and is described in the manual for the basic unit.

Calibration of device – *CAL* key

The menu *CAL* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit.

Setup of device – *SETUP* key

The menu *SETUP* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit. The usage of transducer factors is possible in the Code-Domain as well as in the RF measurements.

Printing – *HCOPY* key

The menu *HCOPY* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit.

All keys on the front panel of the unit that are not specifically mentioned are identical to those of the basic unit. The functions of the keys and the softkeys are described in the manual of the basic unit.

7 Remote Control Commands

This chapter describes the remote control commands for the cdma2000/1xEV-DV base station test application firmware. An alphabetical list following the description provides a quick overview of the commands.

The commands, which also apply to the basic unit in SPECTRUM mode, and the system settings are described in the operating manual for the analyzer.

CALCulate:FEED subsystem

The CALCulate:FEED subsystem selects the type of evaluation for the measurement data. This corresponds to the result display selection in manual operation.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2> :FEED	<string>		No query

:CALCulate<1|2>:FEED <string>

This command selects the measured data that will be displayed.

Parameters: <string>::= 'XPOW:CDP' |
'XPOW:CDP:RAT' |
'XPOW:CDEP' |
'XTIM:CDP:MACCuracy' |
'XTIM:CDP:PVSLot' |
'XTIM:CDP:PVSYmbol' |
'XTIM:CDP:BSTReam' |
'XTIM:CDP:ERR:SUMM' |
'XTIM:CDP:ERR:CTABle' |
'XTIM:CDP:ERR:PCDomain' |
'XTIM:CDP:SYMB:CONStellation' |
'XTIM:CDP:SYMB:EVM' |
'XTIM:CDP:COMP:CONStellation'

The meanings of the string parameters are as follows:

'XPOW:CDP' Result display of the code domain power (absolute) in the bar graph (CALCulate<1>)

'XPOW:CDP:RAT' Result display of the code domain power ratio (relative) in the gar graph (CALCulate<1>)

'XPOW:CDEP' Result display of the code domain power in the bar graph (CALCulate<1>)

'XTIM:CDP:ERR:SUMM' Tabular display of results (CALCulate2)

'XTIM:CDP:ERR:CTABle' Display of channel occupation table (CALCulate<1>)

'XTIM:CDP:ERR:PCDomain' Result display of peak code domain error (CALCulate2)

'XTIM:CDP:MACCuracy' Result display of composite EVM (CALCulate2)

'XTIM:CDP:PVSLot' Result display of power versus power control group (CALCulate2)

'XTIM:CDP:PVSYmbol' Result display of power versus symbol (CALCulate2)

'XTIM:CDP:BSTReam' Result display of bitstream (CALCulate2)

'XTIM:CDP:SYMB:CONStellation' Result display of symbol constellation (CALCulate2)

'XTIM:CDP:SYMB:EVM' Result display of error vector magnitude (CALCulate2)

'XTIM:CDP:COMP:CONStellation' Result display of composite constellation (CALCulate2)

Example:

```
"INST:SEL BC2K"      'Activate cdma2000 BTS
"INIT:CONT OFF"      'Select single sweep
"CALC2:FEED 'XTIM:CDP:MACC'"
                     'Select COMP EVM evaluation
"INIT;*WAI"          'Start measurement with
                     'synchronization
"TRAC? TRACE2"       'Query COMP EVM data
```

Features:

*RST value:	'XPOW:CDP:RAT'	(CALCulate<1>)
	'XTIM:CDP:ERR:SUMM'	(CALCulate<2>)
SCPI:	Compliant	

Note: *The code domain power measurements are always shown in split screen mode and the allocation of the evaluation to the measurement window is fixed. The necessary or allowed numerical suffix in* `CALCulate` *is therefore specified in brackets in every evaluation.*

CALCulate:LIMit:SPECtrum subsystem

The CALCulate:LIMit:SPECtrum subsystem defines the limit check for spectral measurements.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2> LIMit<1...8> :ESPectrum			
:MODE	AUTO | MANual | USER		
:VALue	<numeric_value>	DBM	
:RESTore			
:CHECk			
:X?			Query onlye
:Y?			Query only

:CALCulate:LIMit:ESPectrum:MODE AUTO | MANual | USER

This command automatically enables and disables automatic selection of the limit line in the spectrum emission mask measurement.

The limit lines normally depend on the selected band class.
(Command `CONF:CDP:BCL`)

Parameters:

AUTO	The limit line depends on the measured channel power
MANUAL	One of the three specified limit lines is set. The selection is made with the command `CALC:LIM:ESP:VAL`
USER	Query only, user-defined limit lines are enabled (refer to the description of limit lines in the manual for the unit)

Example:

```
"INST:SEL BC2K"                  'Activate cdma2000 BTS
"INIT:CONT OFF"                  'Select single sweep
"CONF:CDP:BCL 1"                 'Select band class 1, 1900 MHz
"CONF:CDP:MEAS ESP"              'Select spectrum emission mask
                                 'measurement
"CALC:LIM:ESP:MODE AUTO"         'Activates automatic selection of the
                                 'limit line
"INIT;*WAI"                      'Start measurement with
                                 'synchronization
"CALC:LIM:FAIL?"                 'Query result of the limit check
```

Features:

*RST value: AUTO
SCPI: device-specific

:CALCulate:LIMit:ESPectrum:VALue <numeric_value>

This command switches to manual limit line selection. The limit line is selected by specifying the expected power as a value. One of the four possible limit lines is selected depending on the value entered:

Specified value in dBm	Selected limit line	Value when queried
Value ≥ 33	"P ≥ 33"	33
28 ≤ value < 33	„28 ≤ P < 33"	28
Value < 28	"P < 28"	0

Example:

```
"INST:SEL BC2K"                 'Activate cdma2000 BTS
"INIT:CONT OFF"                 'Select single sweep
"CONF:CDP:BCL 1"                'Select band class 1, 1900 MHz
"CONF:CDP:MEAS ESP"             'Select spectrum emission mask
                                'measurement
"CALC:LIM:ESP:VALue 33"         'Activates manual selection of the
                                'limit line and selects the one for P≥33
"INIT;*WAI"                     'Start measurement with 'synchronization
"CALC:LIM:FAIL?"                'Query result of the limit check
```

Features: *RST value: 0
SCPI: device-specific

:CALCulate:LIMit:ESPectrum:RESTore

This command restores the standard limit lines for the spectrum emission mask measurement. All changes made to the standard limit lines are lost and the state of these limit lines as they left the factory is restored .

Example:

```
"INST BC2K"                     'Activate cdma2000 BTS
"CALC:LIM:ESP:REST"             'Resets the spectrum emission mask
                                'limit lines to the default setting
```

Features: *RST value: --
SCPI: device-specific

This command is an event and therefore has neither a query function nor a *RST value.

:CALCulate:LIMit:ESPectrum:CHECk:X?;Y?

These commands query the worst fail position.

Example:

```
"INST:SEL BC2K"                 'Activate cdma2000 BTS
"INIT:CONT OFF"                 'Select single sweep
"CONF:CDP:BCL 1"                'Select band class 1, 1900 MHz
"CONF:CDP:MEAS ESP"             'Select spectrum emission mask
                                'measurement
"CALC:LIM:ESP:VALue 33"         'Activates manual selection of the
                                'limit line and selects the one for P≥33
"INIT;*WAI"                     'Start measurement with 'synchronization
"CALC:LIM:ESP:CHEC:X?;Y?"       'Query result of worst fail position
```

Features: *RST value: --
SCPI: device-specific

CALCulate:MARKer subsystem

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2> :MARKer<1...4> :FUNCtion :PICH :TDPich :CDPower [:BTS] :RESult?	SLOT | PTOTal | PPICh | RHO | MACCuracy | PCDerror | ACTive | FERRor | FERPpm | CERRor | TFRame I IQOFfset | IQIMbalance | SRATe | CHANnel | SFACtor | TOFFset | POFFset | CDPabsolute | CDPRelative | EVMRms | EVMPeak | DMTYpe		Query only

:CALCulate<1|2>:MARKer<1>:FUNCtion:PICH

This command sets marker1 to channel 0.64.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"INIT;*WAI"              'Start measurement with
                         'synchronization
"CALC:MARK:FUNC:PICH"    'Activate marker and position at pilot '0.64
"CALC:MARK:Y?"           'Query value of the CDP rel. of the PICH
```

Features: *RST value: -
SCPI: device-specific

This command is an "event" and therefore has neither a *RST value nor a query function.

:CALCulate<1|2>:MARKer<1>:FUNCtion:TDPIch

This command sets marker1 to channel 16.128. The base spreading factor should be set to 128 beforehand and antenna 2 should be measured.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:ANT 2"              'Select antenna 2
"CDP:SFAC 128"           'Select base spreading factor 128
"INIT;*WAI"              'Start measurement with synchronization
"CALC:MARK:FUNC:PICH"    'Activate marker and position
                         'at TDPICH 16.128
"CALC:MARK:Y?"           'Query value of the CDP rel.
                         'of the TDPICH
```

Features: *RST value: -
SCPI: device-specific

This command is an "event" and therefore has neither a *RST value nor a query function.

:CALCulate<1|2>:MARKer<1>:FUNCtion:CDPower[:BTS]:RESult?
SLOT | PTOTal | PPICh | RHO | MACCuracy | PCDerror | ACTive | FERRor | FERPpm | CERRor | TFRame I IQOFfset | IQIMbalance | SRATe | CHANnel | SFACtor | TOFFset | POFFset | CDPabsolute | CDPRelative | EVMRms | EVMPeak | DMType

This command queries the measured and calculated values of the code domain power analysis. The channel results are provided for the channel to which the code selected by means of the `CDPower:CODe` command belongs.

Parameters:

Global results of the selected PCG:

SLOT	PCG number
PTOTal	Total power in dBm
PPICh	Pilot power in dBm
RHO	RHO
MACCuracy	Composite EVM in %
PCDerror	Peak code domain error in dB
IQOFfset	IQ offset in %
IQIMbalance	IQ imbalance in %

Global results of all PCGs:

FERRor	Frequency error in Hz
FERPpm	Frequency error in ppm
CERRor	Chip rate error in ppm
TFRame	Trigger to frame
ACTive	Number of active channels

Channel results:

DMTYpe	Modulation type (1 = BPSK, 2 = QPSK, 3 = 8-PSK, 4= 16-QAM)		
SRATe	Symbol rate in ksps	TOFFset	Timing offset in s
CHANnel	Channel number	POFFset	Phase offset in rad
SFACtor	Spreading factor of channel		
CDPRelative	Channel power, relative, in dB (relative to total or PICH power, refer to command `CDP:PREF`)	CDPabsolute	Channel power, abs., in dBm
EVMRms	Error vector magnitude rms in %	EVMPeak	Error Vector Mag. Peak in %

Hint:
The value trigger to frame (`TFRame`) delivers a '9' if the trigger is set to FREE RUN.
The values timing/phase offset (`TOFFset/POFFset`) deliver a '9' if the timing and phase offset measurement is switched off (refer to `CDP:TPM`)or the number of active channel exceeds 50.

Example:

```
"INST:SEL BC2K"                  'Activate cdma2000 BTS, implicit are
                                 'CDP relative on screen A and
                                 'result summary active on screen B
"INIT:CONT OFF"                  'Select single sweep
"INIT;*WAI"                      'Start measurement with
                                 'synchronization
"CALC:MARK:FUNC:CDP:RES? PTOT"   'Read out total power
"CDP:SLOT 2"                     'Select power control group 2
"CDP:CODE 11"                    'Select code number 11
"CALC:MARK:FUNC:CDP:RES? EVMR"   'Read out EVM rms of the code with
                                 'number 11in PCG 2
```

Features:

*RST value:	-
SCPI:	device-specific

CALCulate:STATistics subsystem

The CALCulate:STATistics subsystem controls the statistical measurement functions in the unit. The measurement functions cannot be selected for these measurement functions. The numerical suffix is ignored accordingly with CALCulate.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate			
:STATistics			
:CCDF			
[:STATe]	<Boolean>		
:NSAMples	<numeric_value>		
:SCALe			
:Y			
:UPPer	<numeric_value>		
:LOWer	<numeric_value>		
:RESults?	MEAN | PEAK | CFACtor | ALL		Query only

:CALCulate:STATistics:CCDF[:STATe] ON | OFF

This command enables and disables measurement of the complementary cumulated distribution function (CCDF).

Example: "CALC:STAT:CCDF ON"

Features: *RST value: OFF
SCPI: device-specific

:CALCulate:STATistics:NSAMples 100 ... 1E9

This command sets the number of measurement points for the statistical measurement functions.

Example: "CALC:STAT:NSAM 5000"

Features: *RST value: 100000
SCPI: device-specific

:CALCulate:STATistics:SCALe:Y:UPPer 1E-5 ...1.0

This command defines the upper limit for the y-axis of the diagram in statistical measurements. Since probabilities are plotted on the y-axis, the entered numerical values have no units.

Example: "CALC:STAT:SCAL:Y:UPP 0.01"

Features: *RST value: 1.0
SCPI: device-specific

:CALCulate:STATistics:SCALe:Y:LOWer 1E-6 ...0.1

This command defines the lower limit for the y-axis of the diagram in statistical measurements. Since probabilities are plotted on the y-axis, the entered numerical values have no units.

Example: "CALC:STAT:SCAL:Y:LOW 0.001"

Features: *RST value: 1E-6
SCPI: device-specific

CALCulate:STATistics:RESult? MEAN | PEAK | CFACtor | ALL

This command reads out the results of statistical measurements from a recorded trace.

Parameters: The desired result is selected by means of the following parameters:

MEAN — Mean (rms) power measured in dBm measured in the period of analysis

PEAK — Peak power in dBm measured in the period of analysis

CFACtor — Determined CREST factor (i.e. ratio of peak power to mean power) in dB

ALL — Results of all three named measurements, separated by a comma:

<mean power>,<peak power>,<crest factor>

Example:

```
"CALC:STAT:RES? ALL"
```

'Reads out all three measurement results.
Example of reply string:
5.56,19.25,13.69
i.e. mean power: 5.56 dBm,
peak power 19.25 dBm,
CREST factor 13.69 dB

Features: *RST value: --
SCPI: device-specific

Operating mode: A

CONFigure:CDPower subsystem

This subsystem contains the commands for the selection and configuration of measurements in the cdma2000/1xEV-DV application firmware. The numerical suffix 1 is allowed with CONFigure. You will find more example of the code domain power analysis under the :[SENSe]:CDPower command.
Further settings for the spectrum emission mask measurement can be found under the CALCulate:LIMit:ESPectrum command.

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			
:CDPower			
[:BTS]			FS-K82 option
:MEASurement	POWer | ACLR | ESPectrum | OBANdwidth | OBWidth | CDPower | CCDF		
:CTABle			
[:STATe]	<Boolean>		
:SELect	<file_name>		
:NAME	<file_name>		
:DATA	<numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value> ...		
:COMMent	<string>		
:COPY	<file_name>		
:DELete			
:CATalog?			
:RESTores			
:BCLass	<numeric_value>		

CONFigure<1>:CDPower[:BTS]**:MEASurement** POWer | ACLR | ESPectrum | OBANdwith | OBWidth | CDPower | CCDF

This command selects the measurement of the application FS-K82, cdma2000 base station test. The predefined settings of the different measurements are described at length in Chapter 6.

Parameters:

POWer	Channel power measurement (standard cdma2000 Forward) with predefined settings
ACLR	Adjacent channel power measurements (standard cdma2000 Forward) with predefined settings
ESPectrum	Check of signal power (spectrum emission mask)
OBANdwith | OBWidth	Measurement of the occupied bandwidth
CDPower	Code domain analyzer measurement.
CCDF	Measurement of the complementary cumulative distribution function (signal statistics)

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS
"INIT:CONT OFF"          'Select single sweep
"CONF:CDP:MEAS POW"      'Select channel power measurement
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Feature: *RST value: CDPower
SCPI: device-specific

CONFigure<1>:CDPower[:BTS]:CTABle[:STATe] ON | OFF

This command enables and disables the channel table. Enabling results in the measured channel table is saved as "RECENT" and enabled. After the channel table called "RECENT" has been enabled, another channel table can be selected with the `CONF:CDP:CTABle:SELect` command

Note: You must always enable the "RECENT" channel table first with the `CONF:CDP:CTAB:STAT` *command and then use the* `CONF:CDP:CTAB:SELect` *command to select the channel table you required*

Example:

```
"INST:SEL BC2K"                  'Activate cdma2000 BTS, implicit are
                                 'CDP relative on screen A and
                                 'result summary active on screen B
"INIT:CONT OFF"                  'Select single sweep
"INIT;*WAI"                      'Start measurement with
                                 'synchronisation, so switch on of
                                 'predefined tables is possible
"CONF:CDP:CTAB ON"               'Use predefined channel table
"CONF:CDP:CTAB:SEL 'CTAB_1'"     'Select channel table
"INIT;*WAI"                      'Start measurement with
                                 'synchronization
```

Example:

Features: *RST value: OFF
SCPI: device-specific

CONFigure<1>:CDPower[:BTS]:CTABle:SELect <string>

This command selects a predefined channel table file. Before using this command, you must enable the "RECENT" channel table first by means of the `CONF:CDP:CTAB ON` command.

Example:

```
"INST:SEL BC2K"                  'Activate cdma2000 BTS, implicit are
                                 'CDP relative on screen A and
                                 'result summary active on screen B
"INIT:CONT OFF"                  'Select single sweep
"INIT;*WAI"                      'Start measurement with
                                 'synchronisation, so switch on of
                                 'predefined tables is possible
"CONF:CDP:CTAB ON"               'Use predefined channel table
"CONF:CDP:CTAB:SEL 'CTAB_1'"     'Select channel table
"INIT;*WAI"                      'Start measurement with
                                 'synchronization
```

Features: *RST value: "RECENT"
SCPI: device-specific

:CONFigure:CDPower[:BTS]:CTABle:NAME <file_name>

This command selects a channel table for editing or creating. It is not used for the analysis. In this respect refer to the commands `CONF:CDP:CTAB:STAT and CONF:CDP:CTAB:SEL`.

Example:

```
"INST:SEL BC2K"                  'Activate cdma2000 BTS
"CONF:CDP:CTAB:NAME 'NEW_TAB'"   'Select table for editing
```

Features: *RST value: ""
SCPI: device-specific

:CONFigure:CDPower[:BTS]:CTABle:DATA 0..13, 2..7, 0..127, 0..30, 0, 0, 0 | 1, <numeric_value>...

This command defines a channel table. The whole table is defined in one go. The inactive channels (INACtive) do not have to be defined. Eight values are specified for a line of table.

<Channel type >, <Code class>, <Code number>, <Radio configuration>, <Reserved1>, <Reserved2>, <Status>, <CDP relative [dB]>, ...

Channel type	The channel type is coded with numbers as follows: 0 = PICH 1 = SYNC 2 = PCH 3 = TDPICH 4 = APICH 5 = ATDPICH 6 = BCH 7 = CPCCH 8 = CACH 9 = CCCH 10 = CHAN 11 = INACTIVE 12 = PDCCH 13 = PDCH
Code class:	2 to 7
Code number:	0 to 127
Radio configuration	0 for all special channels; for the others (CHAN), the values 1, 2, 3, 4 and 5 are allowed, for PDCH depending on the modulation the following values are used: 10 – QPSK, 20 – 8PSK, 30 – 16QAM
Reserved1:	Always 0 (reserved)
Reserved2:	Always 0 (reserved)
Status:	0: inactive, 1:active Can be used in a setting command to disable a channel temporarily
CDP relative:	Any with setting command, relative with CDP query

Before using this command, you must set the name of the channel table using the `CONF:CDP:CTAB:NAME` command.

Example:
```
"INST:SEL BC2K"                    'Activate cdma2000 BTS
"CONF:CDP:CTAB:NAME 'NEW_TAB'" 'Select table for editing
"CONF:CDP:CTAB:DATA 0,6,0,0,0,0,1,0.0,
                    10,5,3,4,0,0,1,0.0"
                                   'Selects PICH 0.64 and data channel
                                   'with RC4/Walsh code 3.32.
```

Features: *RST value: -
SCPI: device-specific

:CONFigure:CDPower[:BTS]:CTABle:COMMent <string>

This command defines a comment on the selected channel table.

Before using this command, you must set the name of the channel table using the `CONF:CDP:CTAB:NAME` command and enter a valid channel table by means of `CONF:CDP:CTAB:DATA`.

Example:
```
"INST:SEL BC2K"                    'Activate cdma2000 BTS
"CONF:CDP:CTAB:NAME 'NEW_TAB'" 'Select table for editing
"CONF:CDP:CTAB:COMM 'Comment for NEW_TAB'"
```

Features: *RST value: ""
SCPI: device-specific

:CONFigure:CDPower[:BTS]:CTABle:COPY <file_name>

This command copies one channel table to another. You select the channel table you want to copy by means of the `CONF:CDP:CTAB:NAME` command.

Parameter: <file_name> ::= name of the new channel table

Example:
```
"INST:SEL BC2K"                  'Activate cdma2000 BTS
"CONF:CDP:CTAB:NAME 'CTAB_1'"    'Select table for editing
"CONF:CDP:CTAB:COPY 'CTAB_2'"    'Copies CTAB_1 to C_TAB2
```

Features: *RST value: --
SCPI: device-specific

The name of the channel table may contain up to 8 characters. This command is an "event" and therefore has neither a *RST value nor a query function.

:CONFigure:CDPower[:BTS]:CTABle:DELete

This command deletes the selected channel table. You select the channel table you want to delete by means of the `CONF:C2KP:CTAB:NAME` command.

Example:
```
"INST:SEL BC2K"                  'Activate cdma2000 BTS
"CONF:CDP:CTAB:NAME 'CTAB_2'"    'Select table for editing
"CONF:CDP:CTAB:DEL"              'Deletes CTAB_2
```

Features: *RST value: --
SCPI: device-specific

This command is an "event" and therefore has neither a *RST value nor a query function.

:CONFigure:CDPower[:BTS]:CTABle:CATalog?

This command queries the names of all the channel tables stored on the hard disk for cdma2000 BTS.

The syntax of this output format is as follows:

<Sum of file sizes of all subsequent files>,<Spare storage space on fixed disk>,
<1st file name>,<1st file size>,<2nd file name>,,<2nd file size>,....,<nth file name>,,
<nth file size>,..

Example:
```
"INST:SEL BC2K"                  'Activate cdma2000 BTS
"CONF:CDP:CTAB:CAT?"             'Query catalog
```

Features: *RST value: --
SCPI: device-specific

:CONFigure:CDPower:CTABle:RESTore

This command restores the "predefined channel tables" to the state they were in when the device was supplied. In this way unintended overwriting of these channel tables can be undone.

Example:
```
"INST:SEL BC2K"                  'Activate cdma2000 BTS
"CONF:CDP:CTAB:REST"             'Restore table
```

Features: *RST value: --
SCPI: Device-specific

This command is an "event" and therefore has neither a *RST value nor a query function.

:CONFigure:CDPower[:BTS]:BCLass 0...12

This command selects the band class.

Band class	Name
0	800 MHz Band
1	1900 MHz Band
2	TACS Band
3	JTACS Band
4	Korean PCS Band
5	450 MHz Band
6	2 GHz Band
7	700 MHz Band
8	1800 MHz Band
9	900 MHz Band
10	Secondary 800 MHz Band
11	400 MHz European PAMR Band
12	800 MHz PAMR Band

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS
"INIT:CONT OFF"          'Select single sweep
"CONF:CDP:BCL 1"         'Select band class 1, 1900 MHz
```

Features:

*RST value: 0
SCPI: device-specific

INSTrument subsystem

The INSTrument subsystem selects the operating mode of the unit either by means of text parameters or by means of permanently assigned numbers.

COMMAND	PARAMETER	UNIT	COMMENT
INSTrument [:SELect] :NSELect	 SANalyzer | BC2K <numeric_value>		

:INSTrument[:SELect] SANalyzer | BC2K

This command toggles switches from one operating mode to another by means of text parameters.

The selection cdma2000 BTS (BC2K) sets the unit to a defined state. The preset values are described in Chapter 2, in the section entitled " "Default settings in".

Example: `"INST BC2K"` 'Activate cdma2000 BTS
Features: *RST value: SANalyzer
SCPI: compliant

Switching to `BC2K` requires the option cdma2000 FWD (BTS) R&S FS-K82.

INSTrument:NSELect 1 | 10

This command toggles switches from one operating mode to another by means of numbers.

Parameters: 1: Spectral Analysis mode

10: cdma2000 FWD (BTS) mode

Example: `"INST:NSEL 10"` 'Activate cdma2000 BTS

Features: *RST value: 1
SCPI: compliant

Switching to 10 requires the option cdma2000 FWD (BTS) R&S FS-K82

SENSe:CDPower subsystem

This subsystem sets the parameters for the code domain measurements mode. The numerical suffix for SENSe<1|2> is meaningless for this subsystem.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe<1|2>]			
:CDPower			
:ICTReshold	<numeric_value>	DB	
:SBANd	NORMal | INVerse		
:LEVel			
:ADJust			
:CODE	<numeric_value>	--	
:SLOT	<numeric_value>	--	
:SFACtor	64 | 128	--	
:NORMalize	<Boolean>	--	
:QINVert	<Boolean>	--	
:PREFerence	TOTal | | PICH	--	
:ANTenna	OFF | <numeric_value>	--	
:PNOffset	<numeric_value>	--	
:IQLength	<numeric_value>	--	
:ORDer	HADamard | BITReverse	--	
:TPMeas	<Boolean>	--	
:FDV	<Boolean>	--	

:[SENSe:]CDPower:SFACtor 64 | 128

This command defined the base spreading factor. The base spreading factor should be set to 128 when there are channels of code class 7 (spreading factor 128), since alias power values will otherwise be measured for the code domain power analysis.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:SFAC 128"           'Select base spreading factor 128
"INIT;*WAI"              'Start measurement with
```

synchronization

Features: *RST value: 64
SCPI: device-specific

:[SENSe:]CDPower:CODE 0 ... 127

This command selects the code number. The maximum value depends on the base spreading factor.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:CODE 11"            'Select code number 11
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Features: *RST value: 0
SCPI: device-specific

:[SENSe:]CDPower:NORMalize ON | OFF

This command enables and disables elimination of the IQ offset.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:NORM OFF"           'Elimination of IQ offset disabled
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Features:

*RST value: OFF
SCPI: device-specific

:[SENSe:]CDPower:QINVert ON | OFF

This command inserts the sign of the signal Q-component.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:QINV ON"            'Enable Invert Q-component
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Features:

*RST value: OFF
SCPI: device-specific

:[SENSe:]CDPower:SLOT 0 ...IQLength-1

This command selects the power control group (PCG).

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:SLOT 2"             'Select power control group 2
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Features:

*RST value: 0
SCPI: device-specific

:[SENSe:]CDPower:SBANd NORMal | INVers

This command is used to switch the left and right sideband.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:SBAN INV"           'Swap sidebands
"INIT;*WAI"              'Start measurement with
synchronization
```

Features:

*RST value: NORM
SCPI: device-specific

:[SENSe:]CDPower:ICTReshold -100 dB ...0 dB

This command sets the threshold value from which a channel is regarded as active. The level refers to the signal total power.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:ICTR -10DB"         'Threshold value to -10 dB
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Features: *RST value: -60 dB
SCPI: device-specific

:[SENSe:]CDPower:LEVel:ADJust

This command initiates automatic setting of the RF attenuation and IF gain to the level of the applied signal. The unit is placed in the *ATTEN MANUAL* mode to set RF attenuation and IF gain independently of each other to optimum values. This mode is retained even after the change from cdma2000 BTS mode to SPECTRUM mode.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:LEV:ADJ"            'Start automatic level setting
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Features: *RST value: -
SCPI: device-specific

This command is an "event" and therefore has neither a *RST value nor a query function.

:[SENSe:]CDPower:PREFerence TOTal | PICH

This command sets the reference for the relative CDP measured values to the total power or the PICH power (with antenna 2 the TDPICH power is used).

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:PREF PICH"          'Reference is PICH power
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Features: *RST value: TOTal
SCPI: device-specific

:[SENSe:]CDPower:ANTenna OFF | 1 | 2

This command selects Antenna mode for which the evaluation has to be made. With OFF, no signals with transmit diversity are expected. When the value is 1 or 2, the results of the antenna concerned are evaluated.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:ANT 2"              'Select antenna 2
"CDP:SFAC 128"           'Select base spreading factor 128
"INIT;*WAI"              'Start measurement with
                         'synchronization
"CALC:MARK:FUNC:PICH"    'Activate marker and position
                         'at TDPICH 16.128
"CALC:MARK:Y?"           'Query value of the CDP rel. of the
                         'TDPICH
```

Features:

*RST value: OFF
SCPI: device-specific

:[SENSe:]CDPower:PNOFfset 0...511

This command sets the PN offset of the base station in multiples of 64 chips.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:PNOF 45"            'Set PN offset
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Features:

*RST value: 0
SCPI: device-specific

:[SENSe:]CDPower:IQLength FSU/FSQ: 2...50, FSP: 2..12

This command sets the capture length in multiples of the power control group. The range is from 2 to 50 for Analyzer R&S FSU, R&S FSQ and from 2 to 12 for Analyzer R&S FSP.

Example:

```
"INST:SEL BC2K"          'Activate cdma2000 BTS, implicit are
                         'CDP relative on screen A and
                         'result summary active on screen B
"INIT:CONT OFF"          'Select single sweep
"CDP:IQL 8"              '8 PCGs Capture length
"INIT;*WAI"              'Start measurement with
                         'synchronization
```

Features:

*RST value: 3
SCPI: device-specific

:[SENSe:]CDPower:ORDer HADamard | BITReverse

This command sets the order of the code domain evaluation. The codes are sorted either in Hadamard order or in BitReverse order.

Example:

```
"INST:SEL BC2K"                 'Activate cdma2000 BTS, implicit are
                                'CDP relative on screen A and
                                'result summary active on screen B
"INIT:CONT OFF"                 'Select single sweep
"INIT;*WAI"                     'Start measurement with synchronization
"CDP:ORD HAD"                   'Hadamard order
"TRAC? TRACE2"                  'Read out CDP in Hadamard order
"CDP:ORD BITR"                  'BitReverse order
"TRAC? TRACE2"                  'Read out CDP in BitReverse order
```

Features: *RST value: HADamard
SCPI: device-specific

:[SENSe:]CDPower:TPMeas ON | OFF

This command allows specific activation and deactivation of the timing and phase offset evaluation of the channels for the pilot channel. If the value is OFF or more than 50 channels are active, the value '9' is returned as the result for the timing and phase offset for the commands `TRACe? TRACe1` and `CALC:MARK:FUNC:CDP:RES?` . If the value is ON, the timing and phase offsets are calculated and returned.

Example:

```
"INST:SEL BC2K"                 'Activate cdma2000 BTS, implicit are
                                'CDP relative on screen A and
                                'result summary active on screen B
"INIT:CONT OFF"                 'Select single sweep
"CDP:TPM ON"                    'Activate timing and phase offset
"INIT;*WAI"                     'Start measurement with synchronization
"CDP:SLOT 2"                    'Selects power control group 2
"CDP:CODE 11"                   'Select code number 11
"CALC:MARK:FUNC:CDP:RES? TOFF"  'Read out timing offset of the code
                                'with number 11 in PCG 3
"CALC:MARK:FUNC:CDP:RES? POFF"  'Read out the phase offset of the code
                                'with number 11 in PCG 3
```

Features: *RST value: OFF
SCPI: device-specific

:[SENSe:]CDPower:FDV ON | OFF

This command is necessary in the automatic search mode to support the channel detection. If there is a QPSK modulated channel with spreading-factor 32 it is not possible to distinguish whether it is a data channel (CHAN with radio configuration 3-5) or a PACKET DATA CHANNEL (PDCH with radio configuration 10). This decision is made for the PDCH of the 1xEV-DV system if the value is ON. If the value is OFF (default) the CHAN is detected.

Example:

```
"INST:SEL BC2K"                 'Activate cdma2000 BTS, implicit are
                                'CDP relative on screen A and
                                'result summary active on screen B
"INIT:CONT OFF"                 'Select single sweep
"CALC1:FEED 'XTIM:CDP:ERR:CTAB'" 'Channel table evaluation
"INIT;*WAI"                     'Start measurement with
                                'synchronization
"TRAC? TRACE1"                  'Read out channel table
```

Features: *RST value: OFF
SCPI: device-specific

TRACe subsystem

:TRACe[:DATA] TRACE1 | TRACE2 | CTABle

The command transfers trace data from the controller to the unit, the query command reads trace data from the unit

TRACE1, TRACE2 can be read out, depending on the display.

The trace data (TRACE1 | TRACE2) are formatted as follows for the different displays:

CODE DOMAIN POWER ABSOLUTE/CODE DOMAIN POWER RELATIVE (TRACE1):

The following is output for each channel:

Code class	Code class of the channel. With Hadamard order, normally the code class corresponding to the base spreading factor. With BitReverse order, values between 2 and 7
Code number	Code number of the channel, values between 0 and 127
Level	- For CODE DOMAIN POWER ABSOLUTE in dBm - For CODE DOMAIN POWER RELATIVE in dB (referred to the total or pilot power, refer to the command `CDPower:PREFerence`) In Hadamard order, power values of the different codes are normally specified, in BitReverse order the consolidated channel power is returned.
Power detection	0 - inactive channel 1 - power of own antenna 2 - alias power of own antenna 3 - alias power of other antenna 4 - alias power of own and other antenna. Alias power can be avoided by analysis when the base spreading factor is selected correctly. (Refer to the command `CDPower:SFACtor`)

Thus four values are transferred for all channels:
<Code class>, <Code number>, <Signal level>, <Power ID>, ...

For sorting the channels and consolidation, Hadamard order or BitReverse order (refer to the `CDPower:ORDer` command) is important.
With Hadamard, the different codes are output in ascending order with their code power. The number of output codes corresponds to the base spreading factor.
With BitReverse, codes belonging to a channel are next to each other and are therefore output in the class of the channel with output of the consolidated channel power. The maximum number of output codes or channels cannot be higher than the base spreading factor, but decreases with every concentrated channel.

Example:

The example shows the results of the query for five channels having the following configuration:

```
PICH    0.64        (CC 6)      -7.0 dB
PCH     1.64        (CC 6)      -7.3 dB
CHAN    8.32        (CC 5)      -8.0 dB
CHAN    24.128      (CC 7)      -9.0 dB (alias with 24.64)
SYNC    32.64       (CC 6)     -13.3 dB
```

```
"INST:SEL BC2K"                 'Activate cdma2000 BTS, implicit are
                                'CDP relative on screen A and
                                'result summary active on screen B
"INIT:CONT OFF"                 'Select single sweep
"CDP:ORD HAD"                   'Set order to Hadamard
"INIT;*WAI"                     'Start measurement with
                                'synchronization
"TRAC? TRACE1"                  'Read out CDP relative/Hadamard
                                'Channel 8.32 is distributed to 8.64
                                'and 40.64, in each case with half
                                'power -8 dB -3 dB=-11.0 dB
6, 0, -7.0,1,    6, 1, -7.3,1,
6, 2,-54.6,0,    6, 3,-55.3,0,
    ....         6, 7,-58.2,0,
6, 8,-11.0,1,    6, 9,-53.4,0,
    ....         6,24, -9.0,2,
    ....         6,32,-13.3,1,
    ....         6,40,-11.0,1,
    ....         6,63,-54.7,0
"CDP:ORD BITR"                  'Set order to BitReverse
"TRAC? TRACE1"                  'Read out CDP relative/BitReverse
                                'Channel 8.32 can now be directly read
                                'out with its total power.
                                'The sort is changes in accordance
                                'with BitReverse.
6, 0, -7.0,1,    6,32,-13.3,1,
6,16,-56.3,0,    6,48,-52.8,0,
5, 8, -8.0,1,    6,24, -9.0,2,
    ....         6, 1, -7.3,1,
    ....         6,63,-54.7,0
```

CODE DOMAIN ERROR POWER (TRACE1):

The following is output for each channel:

Code class	Code class of the channel normally corresponding to the class for the CDEP that belongs to the base spreading factor.
Code number	Code number of the channel, values between 0 and 127
Error power	In dB No difference of power between the Hadamard and BitReverse orders
Power ID	0 - inactive channel 1 - power of own antenna 2 - alias power of own antenna 3 - alias power of other antenna 4 - alias power of own and other antenna. Alias power can be avoided by analysis when the base spreading factor is selected correctly. (Refer to the command `CDPower:SFACtor`)

Thus four values are transferred for all channels:
<Code class>, <code number>, <signal level>, <power ID>, ...

For sorting the channels, the Hadamard order or BitReverse order (refer to the `CDPower:ORDer` command) is important.
In Hadamard order, the different codes are sorted in ascending order before being output.
With BitReverse order, codes belonging to any one channel are next to each other.
Because an error power is output with the code domain error power, a consolidation of the power values is not sensible.
The number of output codes therefore generally corresponds to the base spreading factor.

Example:

The example shows the results of the query for five channels having the following configuration:

```
PICH    0.64        (CC 6)      -7.0 dB
PCH     1.64        (CC 6)      -7.3 dB
CHAN    8.32        (CC 5)      -8.0 dB
CHAN    24.128      (CC 7)      -9.0 dB  (alias with 24.64)
SYNC    32.64       (CC 6)     -13.3 dB
```

```
"INST:SEL BC2K"                 'Activate cdma2000 BTS, implicit are
                                'CDP relative on screen A and
                                'result summary active on
                    'screen B
"INIT:CONT OFF"                 'Select single sweep
"CALC2:FEED 'XPOW:CDEP"         'Code domain error power evaluation
"INIT;*WAI"                     'Start measurement with
                                'synchronization
"TRAC? TRACE1"                  'Read out CDEP Hadamard
6, 0,-52.6,1,    6, 1,-60.1,1,
6, 2,-54.6,0,    6, 3,-55.3,0,
    ....         6, 7,-58.2,0,
6, 8,-51.9,1,    6, 9,-53.4,0,
    ....         6,24,-55.7,2,
    ....         6,32,-58.6,1,
    ....         6,40,-60.5,1,
    ....         6,63,-54.7,0
```

CHANNEL TABLE (TRACE1):

The following is output for each channel:

Channel type	The channel type is coded with numbers as follows: 0 = PICH 1 = SYNC 2 = PCH 3 = TDPICH 4 = APICH 5 = ATDPICH 6 = BCH 7 = CPCCH 8 = CACH 9 = CCCH 10 = CHAN 11 = INACTIVE 12 = PDCCH 13 = PDCH
Code class	Code class of the channel, values between 2 and 7
Code number	Code number of the channel, values between 0 and 127
Radio configuration	0 for special channels, 1-5 for CHAN and 10 for RC10 (with CODE CHAN AUTOSEARCH '1' is returned for RCs 1&2, '3' for RCs 3 to 5 and 10 for RC10)
Absolute level	In dBm
Relative level	In dB, referred to the total or pilot power (refer to the `CDPower:PREFerence` command)
Timing offset	Referred to the pilot in seconds
Phase offset	Referred to the pilot in rad If the evaluation of the timing and phase offset is not active (refer to `CDPower:TPMeas`) or more than 50 active channels are in the signal, the value 9 is returned For inactive channels, the value 9 is returned.

The class specifies the spreading factor:
Class 7 corresponds to the highest spreading factor (128, symbol rate 9.6 ksps), and class 2 to the lowest allowed spreading factor (4, symbol rate 307.2 ksps).

Thus eight values are transferred for all channels:
<Channel type>, <Code class>, <Code number>, <Radio configuration>, <Absolute level>, <Relative level>, <Timing offset>, <Phase offset>, ...

All detected special channels are sorted first, followed by the data channels, in ascending order by code class and within the code class in ascending order by code number. The unassigned codes appear at the bottom of the list with the code class of the base spreading factor.

Example: The example shows the results of the query for five channels having the following configuration:

```
PICH    0.64          (CC 6)      -7.0 dB
PCH     1.64          (CC 6)      -7.3 dB
CHAN    8.32          (CC 5)      -8.0 dB
CHAN    24.128        (CC 7)      -9.0 dB  (alias with 24.64)
SYNC    32.64         (CC 6)     -13.3 dB
```

```
"INST:SEL BC2K"              'Activate cdma2000 BTS, implicit are
                             'CDP relative on screen A and
                             'result summary active on screen B
"INIT:CONT OFF"              'Select single sweep
"CALC1:FEED 'XTIM:CDP:ERR:CTAB'"
                             'Channel table evaluation
"INIT;*WAI"                  'Start measurement with synchronization
"TRAC? TRACE1"               'Read out channel table
```

```
0 , 6,  0,  0,   0.0,  -7.0, 9, 9,
1 , 6, 32,  0,  -6.3, -13.3, 9, 9,
2 , 6,  1,  0,  -0.3,  -7.3, 9, 9,
10, 5,  8,  3,  -1.0,  -8.0, 9, 9,
10, 7, 24,  3,  -2.0,  -9.0, 9, 9,
11, 6,  2,  3, -47.6, -54.6, 9, 9,
    ....
11, 6, 63,  3, -47.7, -54.7, 9, 9
```

CHANNEL TABLE (CTABle):

In addition to the results of the channel table which are output using the TRACE1 command, active timing and phase offset measurement (refer to `CDPower:TPMeas`) also has the CTABle query command which displays the maximum values of the TIMING and PHASE OFFSET together with the associated channel.

The following values are output:<Max. time offset in s>, <Code number for max. time>, <Code class for max. time>, <Max. phase offset in rad>, <Code number for max. phase>, <Code class for max. phase>, <Reserved 1>, ..., <Reserved 6>

Example:

```
"INST:SEL BC2K"                 'Activate cdma2000 BTS, implicit are
                                'CDP relative on Screen A and
                                'Result Summary active on Screen B
"INIT:CONT OFF"                 'Select single sweep
"CALC1:FEED 'XTIM:CDP:ERR:CTAB'"
                                'Analyze channel tables
"CDP:TPM ON"                    'Activate timing and phase offset measurement
"INIT;*WAI"                     'Start measurement with synchronization
"TRAC? CTAB"                    'Read out maximum timing and phase offsets
1.20E-009,2,2,                  'Max. time offset with code number and
                                'code class of associated channel
-3.01E-003,15,4,                'Max. phase offset with code number
                                'and code class of associated channel
0,0,0,0,0,0                     '6 reserved values
```

RESULT SUMMARY (TRACE2):

The results of the RESULT SUMMARY are output in the following order:
<SLOT>, <PTOTal>, <PPICh>, <RHO>, <MACCuracy>, <PCDerror>, <ACTive>, <FERRor>, <FERPpm>, <TFRame>, <CERRor>, <IQOFfset>, <IQIMbalance>, <SRATe>, <CHANnel>, <SFACtor>, <TOFFset>, <POFFset>, <CDPRelative>, <CDPabsolute>,<EVMRms>, <EVMPeak>

The results have the following meanings and units:

Global results of the selected PCG:

SLOT	PCG number
PTOTal	Total power in dBm
PPICh	Pilot power in dBm
RHO	RHO
MACCuracy	Composite EVM in %
PCDerror	Peak code domain error in dB
IQOFfset	IQ offset in %
IQIMbalance	IQ imbalance in %

Global results of all PCGs:

FERRor	Frequency error in Hz
FERPpm	Frequency error in ppm
CERRor	Chip rate error in ppm
TFRame	Trigger to frame
ACTive	Number of active channels

Channel results:

SRATe	Symbol rate in ksps
CHANnel	Channel number
SFACtor	Spreading factor of the channel
CDPRelative	Channel power relative in dB
EVMRms	Error vector magnitude rms in %

TOFFset	Timing Offset in s
POFFset	Phase Offset in rad
CDPabsolute	Channel power abs. in dBm (relative to total or PICH power, refer to `CDP:PREF` command)
EVMPeak	Error vector mag. peak in %

Hint: The value trigger to frame (TFRame) delivers a '9' if the trigger is set to FREE RUN. *The values timing/phase offset (TOFFset/POFFset) deliver a '9' if the timing and phase offset measurement is switched off (refer to CDP:TPM) or the number of active channel exceeds 50.*

Hint: The result of the modulation type can be read out with the command "CALC:MARK:FUNC:CDP:RES? DMTY"

POWER VS PCG, PEAK CODE DOMAIN ERR and COMPOSITE EVM (TRACE2):

The number of returned value pairs corresponds to the Capture length.
(Refer to the CDPower:IQLength command).

POWER VS PCG: <Slot number>,<Level value in dB>, <Slot number>, <Level value in dB>,.....;
PEAK CODE DOMAIN ERROR: <Slot number>, <Level value in dB>, ...;
COMPOSITE EVM: <Slot number>, <Value in %>, ...;

SYMBOL EVM (TRACE2):

The number of values depends on the spreading factor:
Spreading factor 128 : 12 values; spreading factor 64 : 24 values
Spreading factor 32 : 48 values; spreading factor 16 : 96 values
Spreading factor 8 : 192 values; spreading factor 4 : 384 values
(With transmit diversity on the number of symbols are reduced to the half.)

<Value in % symbol 0>, <value in % symbol 1>,.....;

POWER VS SYMBOL (TRACE2):

The number of values depends on the spreading factor:
Spreading factor 128 : 12 values; spreading factor 64 : 24 values
Spreading factor 32 : 48 values; spreading factor 16 : 96 values
Spreading factor 8 : 192 values; spreading factor 4 : 384 values
(With transmit diversity on the number of values are reduced to the half.)

<Value in dBm symbol 0>, <value in dBm symbol 1>,.....;

SYMBOL CONST (TRACE2):

The number of value pairs depends on the spreading factor:
Spreading factor 128 : 12 pairs; spreading factor 64 : 24 pairs
Spreading factor 32 : 48 pairs: spreading factor 16 : 96 pairs
Spreading factor 8 : 192 pairs; spreading factor 4 : 384 pairs
(With transmit diversity on the number of pairs are reduced to the half.)

Real and imaginary parts are transferred as value pairs.
<re 0>,<im 0>,<re 1>,<im 1>,.....<re n>, <im n>

COMPOSITE CONST (TRACe2):

The number of value pairs corresponds to the chip number of 1536 chips in a power control group. Real and imaginary parts are transferred as value pairs:

<re chip 0>, <im chip 0>, <re chip 1>, <im chip 1>,.....;

BITSTREAM (TRACE2):

The bitstream of a slot is output. A value is output for each bit (range 0,1), each symbol consists of one bit for BPSK of 2 bits for QPSK of 3 bits for 8PSK and of 4 bits for 16QAM modulated channels.

The number of values depends on the spreading factor:

For BPSK:

Spreading factor 128	:	12	values;	spreading factor 64	:	24	values
Spreading factor 32	:	48	values;	spreading factor 16	:	96	values
Spreading factor 8	:	192	values;	spreading factor 4	:	384	values

For QPSK:

Spreading factor 128	:	24	values;	spreading factor 64	:	48	values
Spreading factor 32	:	96	values;	spreading factor 16	:	192	values
Spreading factor 8	:	384	values;	spreading factor 4	:	768	values

For 8PSK:

Spreading factor 32	:	144	values

For 16QAM:

Spreading factor 32	:	192	values

(With transmit diversity on the number of values are reduced to the half.)

Example of bitstream trace: 0, 0, 1, 0 , 1, 1, 0 ....

STATus-QUEStionable:SYNC Register

This register contains information on the error situation in the code domain power analysis of the FS-K82 option.
It can be queried with the commands "`STATus:QUEStionable:SYNC:CONDition?`" and "`STATus:QUEStionable:SYNC[:EVENt]?`".

Table 7-1 Meaning of bits in STATus:QUEstionable:SYNC Register

Bit No.	Meaning
0	Not used in the FS-K82 application
1	**K82 Frame Sync failed** This bit is set when synchronization is not possible within the application. The reasons for this might be: Wrongly set frequency Wrongly set level Wrongly set PN OFFSET Wrongly set values for Q-INVERT or SIDE BAND INVERT Invalid signal at input
2 to 14	Not used in the FS-K82 application.
15	This bit is always 0.

Table of softkeys with assignment of IEC/IEEE bus commands

Key MEAS or Hotkey MEAS

POWER	:CONFigure<1>:CDPower:MEASurement POWer Result query :CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? CPOWer
ACLR	:CONFigure<1>:CDPower:MEASurement ACLR Result query: :CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? ACPower
NO. OF ADJ CHAN	:SENS:POW:ACH:ACP 2
ADJUST SETTINGS	:SENS:POW:ACH:PRES ACP|CPOW|OBW
SWEEP TIME	:SWE:TIM 1 s
NOISE CORR ON OFF	:SENS:POW:NCORR ON
FAST ALCR ON OFF	:SENS:POW:HSP ON
DIAGRAM FULL SIZE	-
ADJUST REV LVL	:SENS:POW:ACH:PRES:RLEV
ACLR LIMIT CHECK	:CALC:LIM:ACP ON :CALC:LIM:ACP:ACH:RES? :CALC:LIM:ACP:ALT:RES?
EDIT ACLR LIMIT	:CALC:LIM:ACP ON :CALC:LIM:ACP:ACH 0dB,0dB :CALC:LIM:ACP:ACH:STAT ON :CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm ::CALC:LIM:ACP:ACH:ABS:STAT ON :ALC:LIM:ACP:ALT1 0dB,0dB :CALC:LIM:ACP:ALT1:STAT ON :CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm :CALC:LIM:ACP:ALT1:ABS:STAT ON :CALC:LIM:ACP:ALT2 0dB,0dB :CALC:LIM:ACP:ALT2:STAT ON :CALC:LIM:ACP:ALT2:ABS -10dBm,-10dBm :CALC:LIM:ACP:ALT2:ABS:STAT ON
CHANNEL BANDWITH	:SENS:POW:ACH:BWID 1.2288MHz
ADJ CHAN BANDWITH	:SENS:POW:ACH:BWID:ACH 30kHz :SENS:POW:ACH:BWID:ALT1 30kHz :SENS:POW:ACH:BWID:ALT2 30kHz
ADJ CHAN SPACING	:SENS:POW:ACH:SPAC:ACH 750kHz :SENS:POW:ACH:SPAC:ALT1 1.98MHz :SENS:POW:ACH:SPAC:ALT2 4MHz
ACLR ABS REL	:SENS:POW:ACH:MODE ABS
CHAN PWR / HZ	:CALC:MARK:FUNC:POW:RES:PHZ ON|OFF

SPECTRUM EM MASK

```
:CONFigure:CDPower:MEASurement ESPectrum
```

Result query:
```
:CALCulate<1>:LIMit<1>:FAIL?
:CALC:LIM:ESP:CHEC:X?;Y?
```

LIMIT LINE AUTO

```
:CALC:LIM:ESP:MODE AUTO
```

LIMIT LINE MANUAL

```
:CALC:LIM:ESP:MODE MANual
:CALCul:LIM:ESP:VAL <numeric_value>
```

LIMIT LINE USER

```
:CALC:LIMit<1>:NAME <string>
:CALC:LIMit<1>:UNIT DBM
:CALC:LIMit<1>:CONT[:DATA] <num_value>, <num_value>, ...
:CALC:LIMit<1>:CONT:DOMain FREQuency
:CALC:LIMit<1>:CONT:TRACe 1
:CALC:LIMit<1>:CONT:OFFset <num_value>
:CALC:LIMit<1>:CONT:MODE   RELative

:CALC:LIM<1>:UPPer[:DATA] <num_value>, <num_value>..
:CALC:LIM<1>:UPPer:STATe   ON | OFF
:CALC:LIM<1>:UPPer:OFFset <num_value>
:CALC:LIM<1>:UPPer:MARGin <num_value>
:CALC:LIM<1>:UPPer:MODE  ABSolute
:CALC:LIM<1>:UPPer:SPACing LINear
```

Hint:
- If the y calues are entered with the command `:CALCulate:LIMit<1>:LOWer[:DATA]` the limit check is "failed", if the values are below the limit line
- If a user defined limit line is switched on this one has priority over the limit lines selected via AUTO or MANUAL

RESTORE STD LINES

```
:CALC:LIM:ESP:RESTore
```

ADJUST REF LVL

```
:SENS:POW:ACH:PRES:RLEV
```

OCCUPIED BANDWIDTH

```
:CONFigure<1>:CDPower:MEASurement OBANdwidth
```

Result query: `:CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? OBANdwidth`

% POWER BANDWITH

```
:SENS:POW:BWID 99PCT
```

ADJUST SETTINGS

```
:SENS:POW:PRES OBW
```

ADJUST REF LVL

```
:SENS:POW:ACH:PRES:RLEV
```

STATISTICS

```
:CONFigure:CDPower:MEASurement CCDF      or
:CALCulate:STATistics[:BTS]:CCDF[:STATe] ON
```

Result query: `CALCulate:MARKer:X?`

APD

```
:CALC:STAT:APD ON
```

CCDF

```
:CALC:STAT:CCDF ON
```

PERCENT MAPKER

```
:CALC:MARKr:Y:PERC 0...100%
```

NO OF SAMPLES

```
CALC:STAT:NSAM <value>
```

SCALING

X-AXIS REL LVL	:CALC:STAT:SCAL:X:RLEV <value>
X-AXIS RANGE	:CALC:STAT:SCAL:X:RANG <value>
X-AXIS MAX VALUE	:CALC:STAT:SCAL:Y:UPP <value>
X-AXIS MIN VALUE	:CALC:STAT:SCAL:Y:LOW <value>
ADJUST SETTINGS	:CALC:STAT:SCAL:AUTO ONCE
DEFAULT SETTINGSL	:CALC:STAT:PRES

ADJUST SETTINGS	:CALC:STAT:SCAL:AUTO ONCE
CONT MEAS	:INIT:CONT ON; :INIT:IMM
SINGLE MEAS	:INIT:CONT OFF; :INIT:IMM

Hot key RESULTS or Softkey CODE DOM ANALYZER

CODE DOM POWER

```
:CALCulate<1>:FEED "XPOW:CDP:RAT" (relative)
:CALCulate<1>:FEED "XPOW:CDP" (absolute)
```

CODE DOM ERROR

```
:CALCulate<1>:FEED "XPOW:CDEP"
```

COMPOSITE EVM

```
:CALCulate2:FEED "XTIM:CDP:MACCuracy"
```

PEAK CODE DOMAIN ERR

```
:CALCulate2:FEED "XTIM:CDP:ERR:PCDomain"
```

POWER VS PCG

```
:CALCulate2:FEED "XTIM:CDP:PVSLot"
```

RESULT SUMARY

```
:CALCulate2:FEED "XTIM:CDP:ERR:SUMM"
 Result query:
:CALCulate<1|2>:MARKer<1>:FUNCtion:CDPower[:BTS]:RESult?
:PTOTal | FERRor | RHO | PPICh | FERPpm |
:CERRor| TFRame | IQOFfset | IQIMbalance |
:MACCuracy | PCDerror | SLOT | ACTive | SRATe |
:TOFFset | CHANnel | POFFset | SFACtor |
:CDPabsolute | CDPRelative |EVMRms | EVMPeak
```

CHANEL TABLE

```
:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABle"
```

SYMBOL CONST

```
:CALCulate2:FEED "XTIM:CDP:SYMB:CONS"
```

SYMBOL EVM

```
:CALCulate2:FEED "XTIM:CDP:SYMB:EVM"
```

BITSTEAM

```
:CALCulate2:FEED "XTIM:CDP:BSTReam"
```

COMPOSITE CONST

```
:CALCulate2:FEED "XTIM:CDP:COMP:CONS"
```

POWER VS SYMBOL

```
:CALCulate2:FEED "XTIM:CDP:PVSY"
```

SELECT CHANNEL

```
:[SENSe:]CDPower:CODE 0...(BASE SF-1)
```

SELECT PCG

```
:[SENSe:]CDPower:SLOT 0 ...(IQ_CAPTURE_LENGTH-1)
```

ADJUST REF LVL

```
:SENS:POW:ACH:PRES:RLEV
```

Hotkey CHAN CONF

CODE CHAN AUTOSEARCH	:CONFigure:CDPower[:BTS]:CTABle[:STATe] OFF
CODE CHAN PREDEFINED	:CONFigure:CDPower[:BTS]:CTABle[:STATe] ON :CONFigure:CDPower[:BTS]:CTABle:SELect <channel table name>
EDIT CHAN CONF TABLE	---
NEW CHAN CONF TABLE	---
HEADER VALUES	:CONFigure:CDPower[:BTS]:CTABle:NAME "NEW_TAB"
ADD SPECIAL	---
INSERT LINE	---
DELETE LINE	---
MEAS CHAN CONF TABLE	---
SAVE TABLE	--
SORT TABLE	---
PAGE UP	---
PAGE UP	---
DEL CHAN CONF TABLE	:CONFigure:CDPower[:BTS]:CTABle:DELete
COPY CHAN CONF TABLE	:CONFigure:CDPower[:BTS]:CTABle:COPY "CTAB2"
RESTORE STD TABLES	:CONFigure:CDPower[:BTS]:CTABle:RESTore

Hotkey SETTINGS

BAND CLASS	:CONFigure:CDPower:BCLass 1 '1900 MHz
PN OFFSET	:[SENSe:]CDPower:PNOFfset 0...511
BASE SF 64 128	:[SENSe:]CDPower:SFACtor 64 | 128
CAPTURE LENGTH	:[SENSe:]CDPower:IQLength 2..50
FORCE 1xEV-DV	:[SENSe:]CDPower:FDV ON |OFF
CODE PWR ABS REL	:CALCulate<1>:FEED "XPOW:CDP:RAT" (relative) :CALCulate<1>:FEED "XPOW:CDP" (absolute)
POWER REF TOT PICH	:[SENSe:]CDPower:PREFerence TOTal | PICH
ORDER HADAMBITRE	:[SENSe:]CDPower:ORDer HADamard | BITReverse
TIME PHASE ON OFF	:[SENSe:]CDPower:TPMeas ON | OFF
ANT DIV ON OFF	
ANT NO. 64 128	:[SENSe:]CDPower:ANTenna OFF | 1 | 2
INACT CHAN THRESHOLD	:[SENSe:]CDPower:ICTReshold -100 dB ... 0 dB
INVERT Q ON OFF	:[SENSe]:CDP:QINVert ON | OFF
SIDE BAND NORN INV	:[SENSe:]CDPower:SBANd NORMal|INVers
NORMALIZE ON OFF	:[SENSe:]CDPower:NORMalize ON | OFF

8 Performance Test

- Switch off the analyzer before removing or inserting modules.
- Check the setting of the system voltage selector (230 V) before switching on the unit.
- Measure the parameters after a warm-up time of at least 30 min. and the completion of system error correction of the analyzer and the SMIQ. Only then is it ensured that the specifications are complied with.
- Unless specified to the contrary, all settings are performed on the basis of the PRESET.
- The following conventions apply to settings on the analyzer during the measurement:

[***<KEY>***]	Press a key on the front panel, for example [SPAN]
[<SOFTKEY>]	Press a softkey, for example [MARKER -> PEAK]
[<nn unit>]	Enter a value and terminate your input with the unit, for example [12 kHz]
{<nn>}	Enter values specified in one of the following tables.

Successive entries are separated by [:], for example [***SPAN***: 15 kHz]

- The values stated in the sections that follow are not guaranteed; only the data sheet specifications are binding.

Measuring equipment and accessories

Item	Instrument type	Recommended characteristics	Recommended equipment	R&S Order No.	Use
1	Signal generator	Vector signal generator for generating cdmaOne (IS95) signals	SMIQ with options: SMIQB42 SMIQB20 SMIQB11 SMIQ-Z5 PARDATA	1125.5555.xx 1104.7936.02 1125.5190.02 1085.4502.04 1104.8555.02	

Test procedure

The performance test refers exclusively to results of the code domain analyzer.
There is no need to check the results of POWER, ACLR and SPECTRUM measurements, since they are already covered by the performance test of the basic unit.

Default settings on SMIQ:

[PRESET]
[LEVEL : *0 dBm]*
[FREQ: *878.49 MHz]*
DIGITAL STD
IS95
STATE: *ON*

The SMIQ channel list should contain the following entries:

CHAN NO	WALSH CODE	POWER[dB]	DATA	STATE
0 (PILOT)	0	-7.0	0000	ON
1	32	-13.3	PRBS	ON
2	1	-7.3	PRBS	ON
3	9	-10.3	PRBS	ON
4	10	-10.3	PRBS	ON
5	11	-10.3	PRBS	ON
6	15	-10.3	PRBS	ON
7	17	-10.3	PRBS	ON
8	25	-10.3	PRBS	ON
9	33	-10.3	PRBS	OFF
10	34	-10.3	PRBS	OFF
11	35	-10.3	PRBS	OFF
12	36	-10.3	PRBS	OFF
13	37	-10.3	PRBS	OFF
14	38	-10.3	PRBS	OFF
15	39	-10.3	PRBS	OFF
16	40	-10.3	PRBS	OFF
17	41	-10.3	PRBS	OFF

Default settings on analyzer:

[PRESET]
[CENTER: *878.49 MHz]*
[AMPT: *10 dBm]*
[CDMA2k BS]
[TRIG *EXTERN]*
[SETTINGS *TIME/PHASE: 0N]*

[RESULTS *CHANNEL TABLE]*

Test setup and other settings

- Connect the RF output of the SMIQ to the RF input of the analyzer
- Connect the external trigger input of the analyzer to the TRIG1 port of the Z5 PARDATA BNC ADAPTER
- Connect the external reference output of the analyzer to the SMIQ

SMIQ *UTILITIES*
REF OSC
SOURCE: EXT
DIGITAL STANDARD
IS95
MODULATION
FILTER MODE: LOW_EVM

Analyzer ***[SETUP:*** *REFERENCE INT]*

The measurement result displayed on the screen of the analyzer should now be as follows:

BS,1M,C0 :CHANNEL TAB

CF 878.49 MHz | Chan 0.64 | PCG 0 | Max T 0.94 ns @ 32.64 | Max Ph -1.78 mrad @ 15.64

	Type	Chan.SF	Symb Rate ksps	RC	Status	Pwr Abs dBm	Pwr Rel dB	T Offs ns	Ph Offs mrad
Ref	PICH	0.64	19.2	---	active	-6.77	reference	0.00	0.00
10.0 dBm	SYNC	32.64	19.2	---	active	-13.04	-6.29	0.94	-0.67
	PCH	1.64	19.2	---	active	-7.05	-0.30	0.10	-1.21
Att	CHAN	9.64	19.2	1+2	active	-10.06	-3.30	0.48	-0.72
40 dB	CHAN	10.64	19.2	1+2	active	-10.05	-3.30	0.35	0.11
	CHAN	11.64	19.2	1+2	active	-10.06	-3.30	0.20	-1.05
	CHAN	15.64	19.2	1+2	active	-10.05	-3.29	0.12	-1.78
	CHAN	17.64	19.2	1+2	active	-10.05	-3.30	0.30	-1.45
1	CHAN	25.64	19.2	1+2	active	-10.06	-3.30	0.43	-0.56
CLRWR	----	2.64	19.2	3-5	inact	-58.86	-52.11	-.--	-.--
	----	3.64	19.2	3-5	inact	-59.70	-52.95	-.--	-.--
	----	4.64	19.2	3-5	inact	-56.59	-49.84	-.--	-.--

A

BS,1M,C0 :POWER TABLE

SR 19.2 ksps | Chan 0.64 | CF 878.49 MHz | PCG 0

RESULTS FOR PCG 0:			GLOBAL RESULTS:		
Total PWR	0.21	dBm	Carr Freq Error	-64.28	mHz
Pilot PWR	-6.76	dBm	Carr Freq Error	-0.00	ppm
RHO	0.99990		Chip Rate Error	0.18	ppm
Composite EVM	1.01	%	Trg to Frame	-.------	s
Pk CDE (SF 64)	-54.55	dB	Active Channels	9	
IQ Imbal/Offset	0.16/0.18	%			

CHANNEL RESULTS:			Modulation	BPSK	
Symbol Rate	19.2	ksps	Timing Offset	0.00	ns
Channel.SF	0.64		Phase Offset	0.00	mrad
Channel Power Rel	0.00	dB	Channel Power Abs	-6.76	dBm
Symbol EVM	0.28	% rms	Symbol EVM	0.48	% Pk

B

9 Hadamard and BitReverse Code Tables

The following tables show the code sequences with Hadamard and BitReverse orders for the code domain power and code domain error power evaluations.
The example for channel 8.32 (channel number 8 for spreading factor 32) shows in bold type where the different codes of this channel are located.

Table 9-1 Code table for base spreading factor 64

HADAMARD								BITREVERSE							
0	000000	0	0	0	0	0	0	0	0	0	0	0	0	000000	0
1	000001	0	0	0	0	0	1	1	0	0	0	0	0	100000	32
2	000010	0	0	0	0	1	0	0	1	0	0	0	0	010000	16
3	000011	0	0	0	0	1	1	1	1	0	0	0	0	110000	48
4	000100	0	0	0	1	0	0	0	0	1	0	0	0	**001000**	**8**
5	000101	0	0	0	1	0	1	1	0	1	0	0	0	**101000**	**40**
6	000110	0	0	0	1	1	0	0	1	1	0	0	0	011000	24
7	000111	0	0	0	1	1	1	1	1	1	0	0	0	111000	56
8	**001000**	0	0	1	0	0	0	0	0	0	1	0	0	000100	4
9	001001	0	0	1	0	0	1	1	0	0	1	0	0	100100	36
10	001010	0	0	1	0	1	0	0	1	0	1	0	0	010100	20
11	001011	0	0	1	0	1	1	1	1	0	1	0	0	110100	52
12	001100	0	0	1	1	0	0	0	0	1	1	0	0	001100	12
13	001101	0	0	1	1	0	1	1	0	1	1	0	0	101100	44
14	001110	0	0	1	1	1	0	0	1	1	1	0	0	011100	28
15	001111	0	0	1	1	1	1	1	1	1	1	0	0	111100	60
16	010000	0	1	0	0	0	0	0	0	0	0	1	0	000010	2
17	010001	0	1	0	0	0	1	1	0	0	0	1	0	100010	34
18	010010	0	1	0	0	1	0	0	1	0	0	1	0	010010	18
19	010011	0	1	0	0	1	1	1	1	0	0	1	0	110010	50
20	010100	0	1	0	1	0	0	0	0	1	0	1	0	001010	10
21	010101	0	1	0	1	0	1	1	0	1	0	1	0	101010	42
22	010110	0	1	0	1	1	0	0	1	1	0	1	0	011010	26
23	010111	0	1	0	1	1	1	1	1	1	0	1	0	111010	58
24	011000	0	1	1	0	0	0	0	0	0	1	1	0	000110	6
25	011001	0	1	1	0	0	1	1	0	0	1	1	0	100110	38
26	011010	0	1	1	0	1	0	0	1	0	1	1	0	010110	22
27	011011	0	1	1	0	1	1	1	1	0	1	1	0	110110	54
28	011100	0	1	1	1	0	0	0	0	1	1	1	0	001110	14
29	011101	0	1	1	1	0	1	1	0	1	1	1	0	101110	46
30	011110	0	1	1	1	1	0	0	1	1	1	1	0	011110	30
31	011111	0	1	1	1	1	1	1	1	1	1	1	0	111110	62
32	100000	1	0	0	0	0	0	0	0	0	0	0	1	000001	1
33	100001	1	0	0	0	0	1	1	0	0	0	0	1	100001	33
34	100010	1	0	0	0	1	0	0	1	0	0	0	1	010001	17
35	100011	1	0	0	0	1	1	1	1	0	0	0	1	110001	49
36	100100	1	0	0	1	0	0	0	0	1	0	0	1	001001	9
37	100101	1	0	0	1	0	1	1	0	1	0	0	1	101001	41
38	100110	1	0	0	1	1	0	0	1	1	0	0	1	011001	25
39	100111	1	0	0	1	1	1	1	1	1	0	0	1	111001	57
40	**101000**	1	0	1	0	0	0	0	0	0	1	0	1	000101	5
41	101001	1	0	1	0	0	1	1	0	0	1	0	1	100101	37
42	101010	1	0	1	0	1	0	0	1	0	1	0	1	010101	21
43	101011	1	0	1	0	1	1	1	1	0	1	0	1	110101	53
44	101100	1	0	1	1	0	0	0	0	1	1	0	1	001101	13
45	101101	1	0	1	1	0	1	1	0	1	1	0	1	101101	45
46	101110	1	0	1	1	1	0	0	1	1	1	0	1	011101	29
47	101111	1	0	1	1	1	1	1	1	1	1	0	1	111101	61
48	110000	1	1	0	0	0	0	0	0	0	0	1	1	000011	3
49	110001	1	1	0	0	0	1	1	0	0	0	1	1	100011	35
50	110010	1	1	0	0	1	0	0	1	0	0	1	1	010011	19
51	110011	1	1	0	0	1	1	1	1	0	0	1	1	110011	51
52	110100	1	1	0	1	0	0	0	0	1	0	1	1	001011	11
53	110101	1	1	0	1	0	1	1	0	1	0	1	1	101011	43
54	110110	1	1	0	1	1	0	0	1	1	0	1	1	011011	27
55	110111	1	1	0	1	1	1	1	1	1	0	1	1	111011	59
56	111000	1	1	1	0	0	0	0	0	0	1	1	1	000111	7
57	111001	1	1	1	0	0	1	1	0	0	1	1	1	100111	39
58	111010	1	1	1	0	1	0	0	1	0	1	1	1	010111	23
59	111011	1	1	1	0	1	1	1	1	0	1	1	1	110111	55
60	111100	1	1	1	1	0	0	0	0	1	1	1	1	001111	15
61	111101	1	1	1	1	0	1	1	0	1	1	1	1	101111	47
62	111110	1	1	1	1	1	0	0	1	1	1	1	1	011111	31
63	111111	1	1	1	1	1	1	1	1	1	1	1	1	111111	63

Table 9-2 Code table for base spreading factor 128 (part 1)

HADAMARD									BITREVERSE								
0	0000000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0000000	0
1	0000001	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1000000	64
2	0000010	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0100000	32
3	0000011	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1100000	96
4	0000100	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0010000	16
5	0000101	0	0	0	0	1	0	1	1	0	1	0	0	0	0	1010000	80
6	0000110	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0110000	48
7	0000111	0	0	0	0	1	1	1	1	1	1	0	0	0	0	1110000	112
8	**0001000**	0	0	0	1	0	0	0	0	0	0	1	0	0	0	**0001000**	8
9	0001001	0	0	0	1	0	0	1	1	0	0	1	0	0	0	**1001000**	72
10	0001010	0	0	0	1	0	1	0	0	1	0	1	0	0	0	**0101000**	40
11	0001011	0	0	0	1	0	1	1	1	1	0	1	0	0	0	**1101000**	104
12	0001100	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0011000	24
13	0001101	0	0	0	1	1	0	1	1	0	1	1	0	0	0	1011000	88
14	0001110	0	0	0	1	1	1	0	0	1	1	1	0	0	0	0111000	56
15	0001111	0	0	0	1	1	1	1	1	1	1	1	0	0	0	1111000	120
16	0010000	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0000100	4
17	0010001	0	0	1	0	0	0	1	1	0	0	0	1	0	0	1000100	68
18	0010010	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0100100	36
19	0010011	0	0	1	0	0	1	1	1	1	0	0	1	0	0	1100100	100
20	0010100	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0010100	20
21	0010101	0	0	1	0	1	0	1	1	0	1	0	1	0	0	1010100	84
22	0010110	0	0	1	0	1	1	0	0	1	1	0	1	0	0	0110100	52
23	0010111	0	0	1	0	1	1	1	1	1	1	0	1	0	0	1110100	116
24	0011000	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0001100	12
25	0011001	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1001100	76
26	0011010	0	0	1	1	0	1	0	0	1	0	1	1	0	0	0101100	44
27	0011011	0	0	1	1	0	1	1	1	1	0	1	1	0	0	1101100	108
28	0011100	0	0	1	1	1	0	0	0	0	1	1	1	0	0	0011100	28
29	0011101	0	0	1	1	1	0	1	1	0	1	1	1	0	0	1011100	92
30	0011110	0	0	1	1	1	1	0	0	1	1	1	1	0	0	0111100	60
31	0011111	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1111100	124
32	0100000	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0000010	2
33	0100001	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1000010	66
34	0100010	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0100010	34
35	0100011	0	1	0	0	0	1	1	1	1	0	0	0	1	0	1100010	98
36	0100100	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0010010	18
37	0100101	0	1	0	0	1	0	1	1	0	1	0	0	1	0	1010010	82
38	0100110	0	1	0	0	1	1	0	0	1	1	0	0	1	0	0110010	50
39	0100111	0	1	0	0	1	1	1	1	1	1	0	0	1	0	1110010	114
40	**0101000**	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0001010	10
41	0101001	0	1	0	1	0	0	1	1	0	0	1	0	1	0	1001010	74
42	0101010	0	1	0	1	0	1	0	0	1	0	1	0	1	0	0101010	42
43	0101011	0	1	0	1	0	1	1	1	1	0	1	0	1	0	1101010	106
44	0101100	0	1	0	1	1	0	0	0	0	1	1	0	1	0	0011010	26
45	0101101	0	1	0	1	1	0	1	1	0	1	1	0	1	0	1011010	90
46	0101110	0	1	0	1	1	1	0	0	1	1	1	0	1	0	0111010	58
47	0101111	0	1	0	1	1	1	1	1	1	1	1	0	1	0	1111010	122
48	0110000	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0000110	6
49	0110001	0	1	1	0	0	0	1	1	0	0	0	1	1	0	1000110	70
50	0110010	0	1	1	0	0	1	0	0	1	0	0	1	1	0	0100110	38
51	0110011	0	1	1	0	0	1	1	1	1	0	0	1	1	0	1100110	102
52	0110100	0	1	1	0	1	0	0	0	0	1	0	1	1	0	0010110	22
53	0110101	0	1	1	0	1	0	1	1	0	1	0	1	1	0	1010110	86
54	0110110	0	1	1	0	1	1	0	0	1	1	0	1	1	0	0110110	54
55	0110111	0	1	1	0	1	1	1	1	1	1	0	1	1	0	1110110	118
56	0111000	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0001110	14
57	0111001	0	1	1	1	0	0	1	1	0	0	1	1	1	0	1001110	78
58	0111010	0	1	1	1	0	1	0	0	1	0	1	1	1	0	0101110	46
59	0111011	0	1	1	1	0	1	1	1	1	0	1	1	1	0	1101110	110
60	0111100	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0011110	30
61	0111101	0	1	1	1	1	0	1	1	0	1	1	1	1	0	1011110	94
62	0111110	0	1	1	1	1	1	0	0	1	1	1	1	1	0	0111110	62
63	0111111	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1111110	126

Table 9-3 Code table for base spreading factor 128 (part 2)

HADAMARD									BITREVERSE								
64	1000000	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0000001	1
65	1000001	1	0	0	0	0	0	1	1	0	0	0	0	0	1	1000001	65
66	1000010	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0100001	33
67	1000011	1	0	0	0	0	1	1	1	1	0	0	0	0	1	1100001	97
68	1000100	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0010001	17
69	1000101	1	0	0	0	1	0	1	1	0	1	0	0	0	1	1010001	81
70	1000110	1	0	0	0	1	1	0	0	1	1	0	0	0	1	0110001	49
71	1000111	1	0	0	0	1	1	1	1	1	1	0	0	0	1	1110001	113
72	**1001000**	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0001001	9
73	1001001	1	0	0	1	0	0	1	1	0	0	1	0	0	1	1001001	73
74	1001010	1	0	0	1	0	1	0	0	1	0	1	0	0	1	0101001	41
75	1001011	1	0	0	1	0	1	1	1	1	0	1	0	0	1	1101001	105
76	1001100	1	0	0	1	1	0	0	0	0	1	1	0	0	1	0011001	25
77	1001101	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1011001	89
78	1001110	1	0	0	1	1	1	0	0	1	1	1	0	0	1	0111001	57
79	1001111	1	0	0	1	1	1	1	1	1	1	1	0	0	1	1111001	121
80	1010000	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0000101	5
81	1010001	1	0	1	0	0	0	1	1	0	0	0	1	0	1	1000101	69
82	1010010	1	0	1	0	0	1	0	0	1	0	0	1	0	1	0100101	37
83	1010011	1	0	1	0	0	1	1	1	1	0	0	1	0	1	1100101	101
84	1010100	1	0	1	0	1	0	0	0	0	1	0	1	0	1	0010101	21
85	1010101	1	0	1	0	1	0	1	1	0	1	0	1	0	1	1010101	85
86	1010110	1	0	1	0	1	1	0	0	1	1	0	1	0	1	0110101	53
87	1010111	1	0	1	0	1	1	1	1	1	1	0	1	0	1	1110101	117
88	1011000	1	0	1	1	0	0	0	0	0	0	1	1	0	1	0001101	13
89	1011001	1	0	1	1	0	0	1	1	0	0	1	1	0	1	1001101	77
90	1011010	1	0	1	1	0	1	0	0	1	0	1	1	0	1	0101101	45
91	1011011	1	0	1	1	0	1	1	1	1	0	1	1	0	1	1101101	109
92	1011100	1	0	1	1	1	0	0	0	0	1	1	1	0	1	0011101	29
93	1011101	1	0	1	1	1	0	1	1	0	1	1	1	0	1	1011101	93
94	1011110	1	0	1	1	1	1	0	0	1	1	1	1	0	1	0111101	61
95	1011111	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1111101	125
96	1100000	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0000011	3
97	1100001	1	1	0	0	0	0	1	1	0	0	0	0	1	1	1000011	67
98	1100010	1	1	0	0	0	1	0	0	1	0	0	0	1	1	0100011	35
99	1100011	1	1	0	0	0	1	1	1	1	0	0	0	1	1	1100011	99
100	1100100	1	1	0	0	1	0	0	0	0	1	0	0	1	1	0010011	19
101	1100101	1	1	0	0	1	0	1	1	0	1	0	0	1	1	1010011	83
102	1100110	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0110011	51
103	1100111	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1110011	115
104	**1101000**	1	1	0	1	0	0	0	0	0	0	1	0	1	1	0001011	11
105	1101001	1	1	0	1	0	0	1	1	0	0	1	0	1	1	1001011	75
106	1101010	1	1	0	1	0	1	0	0	1	0	1	0	1	1	0101011	43
107	1101011	1	1	0	1	0	1	1	1	1	0	1	0	1	1	1101011	107
108	1101100	1	1	0	1	1	0	0	0	0	1	1	0	1	1	0011011	27
109	1101101	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1011011	91
110	1101110	1	1	0	1	1	1	0	0	1	1	1	0	1	1	0111011	59
111	1101111	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1111011	123
112	1110000	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0000111	7
113	1110001	1	1	1	0	0	0	1	1	0	0	0	1	1	1	1000111	71
114	1110010	1	1	1	0	0	1	0	0	1	0	0	1	1	1	0100111	39
115	1110011	1	1	1	0	0	1	1	1	1	0	0	1	1	1	1100111	103
116	1110100	1	1	1	0	1	0	0	0	0	1	0	1	1	1	0010111	23
117	1110101	1	1	1	0	1	0	1	1	0	1	0	1	1	1	1010111	87
118	1110110	1	1	1	0	1	1	0	0	1	1	0	1	1	1	0110111	55
119	1110111	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1110111	119
120	1111000	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0001111	15
121	1111001	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1001111	79
122	1111010	1	1	1	1	0	1	0	0	1	0	1	1	1	1	0101111	47
123	1111011	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1101111	111
124	1111100	1	1	1	1	1	0	0	0	0	1	1	1	1	1	0011111	31
125	1111101	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1011111	95
126	1111110	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0111111	63
127	1111111	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1111111	127

10 Glossary

1xEV-DV	First evolution data and voice, enhancement of cdma2000 towards packet data transmission
APICH	Auxiliary pilot channel.
ATDPCH	Auxiliary transmit diversity channel.
BCH	Broadcast channel.
CACH	Common assignment channel.
CCCH	Common control channel.
CDEP	Code domain error power.
CDP	Code domain power.
Composite EVM	In accordance with the 3GPP2 specifications, the square root of the squared error between the real and the imaginary parts of the test signal and an ideally generated reference signal is determined (EVM referred to the total signal) in a composite EVM measurement.
CPCCH	Common power control channel.
Crest factor	Ratio of peak to average value of the signal.
Inactive Channel Threshold	Minimum power that a single channel must have compared with the total signal to be recognized as an active channel .
MC1	Multi-carrier1 (one carrier system 1X).
MC2	Multi-carrier3 (three carrier system 3X).
OTD	Orthogonal transmit diversity. Two antennas used.
PCG	Power control group: name in cdma2000 system for 1536 chips or 1.25 ms interval. Transmitter power is constant during a power control group.
PCH	Paging channel.
PDCH	Packet Data Channel
PDCCH	Packet Data Control Channel

PICH	Pilot channel 0.64.
RC	Radio configuration. Definition of sampling rate, permissible data rates, modulation types and use of special channels, and transmit diversity.
SF	Spreading factor.
SYNC	Synchronisation channel 32.64.
TD	Transmit diversity. Use of two antennas.
TDPICH	Transmit diversity pilot channel 16.128.
x.y	Walsh code x.y, where: x is the code number and y is the spreading factor of the channel.

11 Index

A

ACLR 6.3
Adjacent channel power 6.3
  number of channels 6.5
Alias power 6.30, 6.32
Amplitude power distribution 6.22, 6.23
Amplitude probability distribution function 6.22, 6.23
Attenuation
  mechanical 6.57
Average 6.61

B

Base spreading factor 7.15
BITSTREAM 6.41

C

Carr Freq Err 6.37
CCDF
  complementary cumulative distribution function 6.22, 6.23
Center frequency 6.56
Chan # 6.39
Channel 6.38
  active 6.53
  bandwidth 6.9, 6.10
  number 6.5
  status 6.49
Channel assignment table 6.39
Channel number 6.48
Channel power 6.2
  absolute/relative 6.11
  relative 6.48
Channel type 6.48
Channel, active 10.1
Checking desired characteristics 8.1
Chip Rate Err 6.38
Code domain error power 6.32
Code domain power 6.30
Commands
  assignment to soft key **7.27**
  description 7.1
Common pilot channel 10.1
Complementary distribution function 6.23
Composite constellation 6.42
Composite EVM 6.37
CPICH 10.1

D

Default setting 2.2
  scaling on X-axis and Y-axis 6.25
Desired characteristics 8.1
Distribution function 6.23
Distribution function of signal amplitudes 6.22
..... 6.23

E

Error Vector Mag Pk / rms 6.38

F

Fast power measurement 6.7
Frequency
  offset 6.56
Function fields 6.29

H

Hot key
  CDMA2k BS 5.1
  CHAN CONF 4.2, 5.1, 6.45
  EXIT CDMA 5.2
  MEAS 5.2, 6.1
  RESULTS 5.1, 6.28
  SETTINGS 5.1

I

IQ imbalance 6.37
IQ offset 6.37

K

Key
  AMPT 6.57
  BW 6.60
  CAL 6.63
  DISP 6.62
  FILE 6.62
  FREQ 6.56
  HCOPY 6.63
  LINES 6.62
  MARKER 6.58
  MEAS 6.1, 6.60
  MKR FCTN 6.60
  MKR→ 6.59
  PRESET 6.63
  SETUP 6.63
  SPAN 6.56

SWEEP 6.60
TRACE 6.61
TRIG 6.61

L

Limit
ACP measurement 6.8
probability range 6.24
Limit check
ACLR measurement 6.8

M

Marker
maximum 6.59
Max Hold 6.61
Maximum search 6.59
Menu overview 5.1
Min Hold 6.61

N

No. of Active Chan 6.38
Number of active channels 6.38

O

Offset
frequency 6.56
reference level 6.57
Overwrite mode 6.61

P

PCG 6.44
Peak code domain error 6.35, 6.37
Peak value detection 6.61
Performance test 8.1
Phase offset 6.38, 6.39
Pilot channel 6.59
Pilot PWR 6.37
Power
cdma2000 signal 6.12
referred to 1 Hz of bandwidth 6.11
Power bandwidth
percentage 6.21
Power measurement
fast 6.7
Power versus symbol 6.43
Preset 2.2
PWR ABS / PWR REL 6.39

R

Radio configuration 6.39, 6.48
RECENT 6.46
Reference level 6.57
offset 6.57
Remote control 7.1
RESULT SUMMARY (TRACE2) 7.24
RF attenuation
mechanical 6.57
RHO 6.37

S

Scaling 6.24
Search
maximum 6.59
Signal amplitudes, distribution function 6.22, 6.23
Signal statistic 6.22, 6.23
Soft key
% POWER BANDWIDTH 6.21
ACLR 6.1, 6.3, 7.9
ACLR LIMIT CHECK 6.8
ADD PICH 6.49
ADJ CHAN BANDWIDTH 6.10
ADJUST REF LEVEL 6.57
ADJUST REF LVL 6.8, 6.19, 6.21, 6.44
ADJUST SETTINGS 6.5, 6.21, 6.25
ALL MARKER OFF 6.58
ANT DIV 6.55
ANT DIV ON / OFF 7.18
ANT NO 6.55
ANT NO. 1 / 2 ..... 7.18
APD ON/OFF 6.23
AVERAGE 6.61
BAND CLASS 6.52, 7.13
BASE SF 6.30, 6.32, 6.35, 6.53, 7.15
BITSTREAM 6.28, 6.41, 7.1, 7.20
CAPTURE LENGTH . 6.34, 6.35, 6.36, 7.18
CAPTURE LENGTH 6.53
CCDF 7.7, 7.9
CCDF ON/OFF 6.23
CENTER 6.56
CF-STEPSIZE 6.56
CHAN PWR / HZ 6.11
CHAN TABLE HEADER 7.11
CHAN TABLE VALUES 7.11
CHANNEL BANDWIDTH 6.9
CHANNEL TABLE 6.28, 6.39, 7.1, 7.20
CLEAR/WRITE 6.61
CODE CHAN AUTOSEARCH 6.45, 7.10
CODE CHAN PREDEFINED 6.46, 7.10
CODE DOM ANALYZER 6.1, 7.9
CODE DOM ERROR 6.28, 6.32, 7.1
CODE DOM POWER 6.28, 6.30, 7.1, 7.20
CODE PWR ABS/REL 6.53
COMPOSITE CONST 6.28

COMPOSITE CONST 6.42
Composite EVM 7.1, 7.20
COMPOSITE EVM 6.28, 6.34
CONT MEAS 6.25
COPY CHAN CONF TABLE 6.50, 7.12
CP/ACP ABS/REL 6.11
DEFAULT SETTINGS 6.25
DEL CHAN CONF TABLE 6.50, 7.12
DELETE LINE 6.50
DIAGRAM FULL SIZE 6.8
EDIT ACLR LIMITS 6.8
EDIT CHAN CONF TABLE 6.47, 7.10
FAST ACLR ON/OFF 6.7
FREQUENCY OFFSET 6.56
HEADER/VALUES 6.48
INACT CHAN THRESHOLD 6.53, 7.17
INSERT LINE 6.50
INSTALL OPTION 1.1
INVERT Q 6.55, 7.16
LIMIT LINE AUTO 6.13, 7.3
LIMIT LINE MANUAL 6.13, 7.3
LIMIT LINE USER 6.19, 7.3
MARKER -> PICH 6.59, 7.5
MARKER -> TDPICH 6.59, 7.5
MARKER 1 to 4 ..... 6.58
MARKER NORM/DELTA 6.58
MAX HOLD 6.61
MEAS CHAN CONF TABLE 6.50
MIN HOLD 6.61
NEW CHAN CONF TABLE 6.51, 7.10
NEXT PEAK 6.59
NO OF SAMPLES 6.23, 7.7
NO. OF ADJ CHAN 6.5
NOISE CORR ON/OFF 6.7
NORMALIZE ON/OFF 6.55, 7.16
OCCUPIED BANDWIDTH 6.1, 6.20, 7.9
ORDER 6.54, 7.19
PEAK 6.59
PEAK CODE DOMAIN ERR 6.28, 6.35, 7.1, 7.20
PEAK MODE MIN/MAX 6.59
PERCENT MARKER 6.23
PN OFFSET 6.53, 7.18
POWER 6.1, 6.2, 7.9
POWER REF TOT/PICH 6.54, 7.17
POWER VS PCG 6.28, 6.36, 7.1, 7.20
POWER VS SYMBOL 6.28, 6.43, 7.1
REF LEVEL OFFSET 6.57
REF LVL 6.57
REF VALUE POSITION 6.57
RESTORE STD LINES 6.19
RESULT DISPLAY 7.1
RESULT SUMMARY 6.28, 6.37, 7.1, 7.20
RF ATTEN AUTO 6.57
RF ATTEN MANUAL 6.57
SAVE TABLE 6.50
SCALING 6.24
SELECT CHANNEL 6.43, 7.15
SELECT MARKER 6.59
SELECT PCG 6.44, 7.16
SETTINGS 6.52
SIDEBAND NORM / INV 6.55, 7.16
SIGNAL STATISTIC 6.1, 6.22
SINGLE MEAS 6.25
SORT TABLE 6.50
SPECTRUM EM MASK 6.1, 6.12, 7.9
SWEEP COUNT 6.61
SWEEP TIME 6.6
SYMBOL CONST 6.28, 7.1, 7.20
SYMBOL CONST 6.40
SYMBOL EVM 6.28, 6.40, 7.1, 7.20
TIME/PHASE 6.54
TIME/PHASE ON / OFF 7.19
X-AXIS RANGE 6.24
X-AXIS REF LEVEL 6.24
Y MAX 7.7
Y MIN 7.7
Y PER DIV 6.57
Y-AXIS MAX VALUE 6.24
Y-AXIS MIN VALUE 6.24
Softkey
RESTORE STD TABLES 6.50, 7.12
Special channels 6.48
Spreading code 6.38
Spreading factor 6.48
Status 6.39
STATus-QUEStionable-SYNC-Register 7.26
Symbol constellation 6.40
Symbol error vector magnitude 6.40
SYMBOL EVM (TRACE2) 7.25
Symbol rate 6.38, 6.39, 6.48

T

Test setup 3.1
Timing offset 6.38, 6.39
Total power 6.11, 6.37
Trace
overwrite mode 6.61
peak value detection 6.61
Transducer 6.63
Transmit diversity pilot channel 6.59
Trg to Frame 6.38

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